AD-A204 620

INSTALLATION RESTORATION PROGRAM
PHASE II-CONFIRMATION/QUANTIFICATION
STAGE 1

For

Minot Air Force Base
Minot, North Dakota

Prepared By:

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October 1988

Volume 2 of 3

Appendices A Through F

Prepared For:

HEADQUARTERS STRATEGIC AIR COMMAND
COMMAND SURGEONS OFFICE (HQ SAC/SGPB)
BIOENVIRONMENTAL ENGINEERING DIVISION
OFFUTT AIR FORCE BASE, NEBRASKA 68113

And

UNITED STATES AIR FORCE OCCUPATIONAL &
ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION QUANTIFICATION

STAGE 1

APPENDICES TO THE FINAL REPORT
FOR

MINOT AIR FORCE BASE
MINOT, NORTH DAKOTA

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United States Air Force Occupational
and Environmental Health Laboratory (USAFOEHL)
Technical Services Division (TS)
Brooks Air Force Base, Texas 78235-5501

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LIST OF APPENDICES (Continued)

APPENDIX A

DEFINITIONS, NOMENCLATURE AND UNITS OF MEASURE

(CL5060B/0528N)

DEFINITIONS, NOMENCLATURE AND UNITS OF MEASURE

Most of the following are derived from the American Geological Institute (1976) Glossary.

Term	Definition
Aquifer	Stratum or zone below the surface of the earth capable of producing a significant amount of water as from a well.
Flow Velocity	The rate a moving fluid travels. Measured in distance traveled over a given period of time.
Gradient	Slope of a stream or land surface.
Ground Water	That part of the subsurface water which is in the zone of saturation.
Hydraulic Conductivity	Ratio of flow velocity to driving force for viscous flow under saturated conditions of a specified liquid in a porous medium.
Lithology	The physical character of a rock.
Permeability	The capacity of a rock or sediment for transmitting a fluid. Degree of permeability depends upon the size and shape of the pores, the size and shape of their interconnections, and the extent of the latter. It is measured by the rate at which a fluid of standard viscosity can move a given distance through a given interval of time.
Potentiometric Surface	Surface to which water in an aquifer would rise by hydrostatic pressure under atmospheric pressure.
Porosity	The ratio of the void volume of a rock or soil to its total volume.
Recharge	a.) Intake. The processes by which water is absorbed and is added to the zone of saturation, either directly or indirectly by way of another formation. b.) The quantity of water that is added to the zone of saturation.
Saturated Thickness	The interval of rock or soil which is saturated with respect to water if all its interstices are filled with water.
Sediment	Solid material settled from suspension in a liquid.

(CL5060B/0528N)

DEFINITIONS, NOMENCLATURE AND UNITS OF MEASURE (CONTINUED)

Term	Definition
Specific Capacity	A constant indicating the discharge expressed as a rate yield per unit of drawdown.
Specific Yield	The ratio of the volume of water which a rock or soil, after being saturated, will yield by gravity to its own volume.
Stratigraphy	That branch of geology which deals with the formation, composition, sequence and correlation of the stratified rocks as parts of the earth's crust.
Transmissivity	The ease with which water moves through a unit width of aquifer.
Water Table	The upper surface of a zone of saturation, except where that surface is formed by an impermeable body.
Zone of Saturation	A subsurface zone in which all the interstices are filled with water under pressure equal to or greater than that of the atmosphere.

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DEFINITIONS, NOMENCLATURE AND UNITS OF MEASURE (CONTINUED)

Abbreviation/ Unit of Measure	Definition
A	Area
AD	Air Division
ADCOM	Aerospace Defense Command
ADI	Acceptable Daily Intake
ADL	Above Detection Limits
AFB	Air Force Base
AVO	Aromatic Volatile Organics
AWQC	Ambient Water Quality Criteria
BMW	Ballistic Missile Wing
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act.
CFR	Code of the Federal Register
CLP	Contract Laboratory Program
cm	centimeter
cm/sec	centimeters per second
COE	United States Army Corps of Engineers
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DOD	Department of Defense
DOH	Department of Health
EPA	United States Environmental Protection Agency
ESE	Environmental Science and Engineering
et al.	and others
EOD	Explosive Ordnance Disposal Area
FR	Federal Register

DEFINITIONS, NOMENCLATURE AND UNITS OF MEASURE (CONTINUED)

Abbreviation/ Unit of Measure	Definition
ft	feet
FTA	Firefighting Training Area
ft/day	feet per day
ft^2/day	squared feet per day
gpm	gallons per minute
HART	Fred C. Hart Associates Inc. (USAF consultant)
HVO	Halogenated Volatile Organics
I	gradient (slope of the water), where Q = KIA; V = KI/p
ID	inside diameter
IN	inch
IRP	Installation Restoration Program (of USAF)
K	permeability, where Q = KIA; V = KI/p
MAFB	Minot Air Force Base
MCL	Maximum Concentration Level
MDL	Minimum Detection Limit
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
min	minutes
mm	millimeters
msl	mean sea level (feet above)
NA	not analyzed
ND	no data; not detected
NDWQS	North Dakota Water Quality Standards

(CL5060B/0528N)

DEFINITIONS, NOMENCLATURE AND UNITS OF MEASURE (CONTINUED)

Abbreviation/ Unit of Measure	Definition
NIPDWS	National Interim Primary Drinking Water Standards
NP	not performed
NR	not reported
NSDWS	National Secondary Drinking Water Standards
OVA	Organic Vapor Analyizer
p	porosity, where V = KI/p
PP	Priority Pollutant
ppb	parts per billion
PPCL	Preliminary Protective Concentration Limit
ppm	parts per million
PTL	Princeton Testing Laboratory (HART consultant)
PVC	polyvinyl chloride (well casing)
Q	discharge rate
QA	quality assurance
QC	quality control
RCRA	Resource Recovery and Conservation Act
RMCL	Recommended Maximum Contaminant Levels
SAC	Strategic Air Command
Sec	seconds
SLA	Sanitary Landfill Area
SMW	Strategic Missile Wing
SNARL	Suggested No-Adverse Response Level
SOW	Statement of Work

(CL5060B/0528N)

DEFINITIONS, NOMENCLATURE AND UNITS OF MEASURE (CONTINUED)

Abbreviation/ Unit of Measure	Definition
SPF	Strategic Protection Force
TDS	Total Dissolved Solids
TOC	top of casing
UCR	unit cancer risk
ug/gm	micrograms per gram
ug/l	micrograms per liter
USAF	United States Air Force
USAFOEHL	United Sates Air Force Occupational & Environmental Health Laboratory
USGS	United States Geological Survey
V	velocity
VOA	volatile organic analysis
VOC	volatile organic compound

(CL5060B/0528N)

APPENDIX B

MAFB TASK DESCRIPTION/STATEMENT OF WORK

(CL5060B/0528N)

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION (STAGE 1)
MINOT AFB ND

I. DESCRIPTION OF WORK

The overall objective of the Installation Restoration Program (IRP) Phase II investigation is to assess potential contamination at past hazardous waste disposal and spill sites on Air Force installations. A series of staged field investigations may be required to meet this objective.

The purpose of this task is to undertake a field investigation at Minot AFB ND to: (1) confirm the presence or absence of contamination within the specified areas of investigation; (2) if possible, determine the extent and degree of contamination and the potential for migration of those contaminants in the various environmental media; (3) identify public health and environmental hazards of migrating pollutants based on State or Federal standards for those contaminants; and (4) delineate additional investigations required beyond this stage to reach the Phase II objectives.

The Phase I IRP Report (mailed under separate cover) incorporates the background and description of the sites/zones for this task. To accomplish this survey effort, the contractor shall take the following actions:

A. General Requirements - The general requirements are applicable to all sites unless modified by the site specific work in Section I.B.

1. Monitor the ambient air during all well drilling and soil boring work with a photoionization meter or equivalent organic vapor detector to identify the generation of potentially hazardous and/or toxic vapors or gases. Include air monitoring results in the boring logs. If soil encountered during borehole drilling is suspected to be hazardous because of abnormal discoloration, odor or air monitoring levels, containerize the soil cuttings in new, unused drums. Enter into the boring logs the depth(s) from which suspected contaminated soil cuttings were collected for containerization. Take a composite sample from the contents of each drum. Collect a maximum of 10 composite samples and test them for EP Toxicity (metals). Use RCRA criteria to determine if soil cuttings must be classified as hazardous waste (40 CFR 261.24).

2. Determine the exact location of all monitor wells and soil borings during the planning/mobilization phase of the field investigation. Consult with base personnel to minimize disruption of base activities, to properly position wells with respect to exact site locations, and to avoid underground utilities. Direct the drilling and sampling and maintain a detailed log of the conditions and materials penetrated during the course of the work. Do not drill boreholes or position wells in actual landfill areas; install wells at the landfill perimeter.

3. Determine the areal extent of the sites by reviewing historical and current panchromatic and infrared aerial photography.

4. Installation of Ground Water Monitoring Wells

a. Comply with the U.S. EPA Publication 330/9-S1-002, NEIC Manual for Ground Water/Subsurface Investigations at Hazard Waste Sites for monitoring well installation.

b. All well drilling, development, purging, sampling methods, and other activity pertaining to this effort must conform to state and other applicable regulatory agency requirements. Cite references in an appendix to the Final Report.

c. Install wells at a sufficient depth to collect samples representative of aquifer quality and to intercept contaminants if they are present.

d. Avoid, when possible, installing wells in depressions or areas subject to frequent flooding and standing water. If wells must be installed in such areas, design the wells such that standing water does not leak into the top of the casing or cascade down the annular space.

e. Drill all monitoring wells using the following specifications:

(1) Drill all wells using hollow-stem auger techniques. A center stem, plug, and bit attached to the stem may be inserted into the auger for use while drilling. This will prevent material from entering into the hollow stem of the auger.

(2) Take lithologic samples at five-foot intervals and prepare borehole log descriptions. Include pilot boring logs and well completion summaries in the Final Report (Item VI, below).

(3) Drill a maximum of 16 wells. Total footage for all wells in this task shall not exceed 500 linear feet. Refer to the site specific details in Section I.B.

(4) Construct each well with two-inch inside diameter (I.D.) Schedule 40 PVC casing. Use threaded screw-type joints, glued fittings are not permitted. Flush thread all connections. Screen each well using two-inch I.D. casing having up to 0.020 inch slots; slot size may vary based upon borehole geology. Screen material must be the same as that of the casing. Cap the bottom of the screen.

(5) Unless specified differently in Section B, Site Specific Work, screen all wells so as to collect floating contaminants and to allow for yearly fluctuations of the water table. Screen all wells a maximum of ten feet.

f. Complete all monitoring wells using the following specifications:

(1) Once the casing is installed, allow the soil formation to collapse around the well screen. Supplement the natural gravel-pack with washed and bagged rounded silica sand or gravel with a grain size distribution compatible with the screen and soil formation. Place the pack from the bottom of the borehole to two feet above the top of the screen. Tremie a five foot bentonite pellet seal above the sand/gravel pack. Ensure the bentonite forms a complete seal. Grout the remainder of the annulus to the land surface with a Type I Portland cement/bentonite slurry.

(2) Check with the base point of contact (POC) to determine whether wells shall be completed flush or project above the ground surface:

(a) If well stick-up is of concern in an area, complete the well flush with the land surface. Cut the casing two to three inches below land surface, and install a protective locking lid consisting of a cast-iron valve box. Center the lid assembly in a three foot diameter concrete pad sloped away from the valve box. Ensure free drainage is maintained within the valve box. Also, provide a screw-type casing cap to prevent infiltration of surface water. Maintain a minimum of one foot clearance between the casing top and the bottom of the valve box. Clearly mark the well number on the valve box lid.

(b) If an above ground surface completion is used, extend the well casing two or three feet above land surface. Provide an end-plug or casing cap for each well. Shield the extended casing with a steel guard pipe which is placed over the casing and cap, and seated in a two-foot by two-foot by four-inch concrete surface pad. Slope the pad away from the well sleeve. Install a lockable cap or lid at the casing. Install three, three-inch diameter steel guard posts if the Base POC determines the well is in an area which needs such protection. The guard posts shall be five feet in total length and installed radially from each wellhead. Recess the guard posts approximately two feet into the ground and anchor with concrete. Do not install the guard posts in the concrete pad placed at the well base. Paint the protective steel sleeve and clearly number the well on the sleeve exterior.

(c) Provide locks for both flush and above-ground well assemblies. Turn over the master keys to the Base POC following completion of the field effort.

(3) As soon as practical after completion, develop each well with a submersible pump, bailer, and/or airlift method. Continue well development until the discharge water is clear and free of sediment to the fullest extent possible. Measure the rate of water produced, the pH, specific conductance and water temperature during well development and include this information in the Final Report.

(4) Determine by survey the elevation of all newly installed monitoring wells to an accuracy of 0.01 foot. Notch the top of the riser casing where well elevations are established. Horizontally locate the new wells to an accuracy of 1.0 foot and record the position on both project and site specific maps. Bench marks used must have previously been established from and be traceable to a USCGS or USGS survey marker.

(5) Measure water levels at all monitoring wells as feet below the ground surface or below the top of casing elevation to the nearest 0.01 foot. Report in terms of mean sea level (MSL). Measure static water levels in wells prior to well development and before all well purging which precedes sampling events.

5. Recommend candidate well abandonment method(s) or technique, including costs, which are applicable to the type of monitoring wells installed and geological conditions. Consider that these wells will be abandoned at some future date after the study objectives have been met and there is no longer a need for the wells. The actual process of well abandonment is not a part of this task order. Assure that the recommended method(s) meets state and/or local well abandonment guidelines or regulations.

6. Complete permits, applications, and other forms which may be required by local and/or state regulatory agencies for the installation of monitor wells. File these documents with appropriate agencies and pay all permitting and filing fees.

7. Soil Borings

a. Conduct five soil borings not to exceed a total of 200 linear feet. Accomplish the borings using hollow-stem auger techniques. Obtain split-spoon samples using ASTM Method D-1586. Refer to the site specific details, Section I.B., for the soil sample collection depths.

b. During the boring operations, describe lithologies encountered and prepare stratigraphic logs. Place special emphasis on field identification of contaminated soils encountered.

c. Scan all split-spoon soil cores with a photoionization meter or equivalent organic vapor detector. Include monitoring results in the boring logs.

d. Whenever possible, measure water levels in all boreholes after the water level has stabilized. Examine the water surface for the presence of hydrocarbons. Include the information in the boring logs.

e. Tremie-grout all boreholes to the surface with a bentonite/cement grout. It is especially important to insure they are adequately resealed to preclude future migration of contaminants.

f. Permanently mark each location where soil borings are drilled. Record the location on a project map for each specific site or zone, whichever is applicable.

8. Well and Borehole Cleanup

Remove all well/borehole cuttings and clean the general area following the completion of each well/borehole. Containerize and store cuttings according to paragraph I.A.1. of this task order. Transport these

drums to a location on Minot AFB designated by the Base POC. The base is responsible for ultimate disposal of contaminated soils using base resources.

9. Field Sampling

a. Strictly comply with the sampling techniques, maximum holding times, and preservation of samples as specified in the following references: Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985), pages 37-44; ASTM, Section 11, Water and Environmental Technology; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 2nd Edition (USEPA, 1984); Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pages xiii to xix (1983); and Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA Document 600/4-82-029 (1982).

b. Allow wells to stabilize after development for a minimum of seven days before sampling.

c. Prior to purging the wells, examine the surface of the water table for the presence of hydrocarbons and take water level measurements to the nearest 0.01 foot with respect to the established survey point on top of the well casing. If applicable, measure the thickness of the hydrocarbon layer and collect a sample of the hydrocarbons. Analyze the samples for petroleum hydrocarbons (Attachment 1 includes an allowance for these samples).

d. Purge the well using a submersible pump, bailer, or other pertinent method. Purge until a minimum of three well volumes (based on borehole diameter) of water have been displaced and the pH, temperature, specific conductance, color, and odor of the discharge have stabilized using the following criteria: pH ± 0.1 unit, temperature ± 0.5°C, and specific conductance ± 10 µmhos. Include the final measurements in the Results section of the report.

e. Collect water samples with a Teflon bailer. However, to collect representative aquifer samples where floating hydrocarbons are present, use a "thief sampler" or similar device to minimize the influence of the free product.

f. If the well(s) cannot be sampled due to well development, well characteristics, or other reason(s), indicate the reason(s) in the report as specified in Item VI below.

g. Permanently mark the location where surface water or sediment samples are collected. Record the location on a project map for each site or zone, whichever applies.

h. Split all water and soil samples. Analyze one set and immediately deliver the other set (the same collection day) to the Base POC. The Base POC will select 10% of the split samples, package the selections with appropriate forms, and deliver them to the contractor within 24 hours of receipt. Supply all packing and shipping materials to the Base POC for packaging the split samples. Immediately ship (within 24 hours) the POC selected samples through overnight delivery to:

USAFOEHL/SA
Bldg 140
Brooks AFB TX 78235-5501

For all split samples sent to the USAFOEHL, complete an AF Form 2752A "Environmental Sampling Data" and/or an AF Form 2752B "Environmental Sampling Data - Trace Organics", (working copies have been provided under separate cover) with the following information:

(1) Date and time collected

(2) Purpose of sample (analyte and sample group)

(3) Installation name (base)

(4) Sample number (on containers)

(5) Source/location and depth of sample

(6) Contract Task Numbers and Title of Project

(7) Method of collection (bailer, suction pump, air-lift pump, split-spoon, etc.)

(8) Volumes removed before sample taken

(9) Special Conditions (use of surrogate standard, etc.)

(10) Preservatives used

(11) Collector's name or initials

In addition, label each sample container with a permanent ink pen (laundry marker) to reflect the data in (1), (2), (3), (4), (10) and (11) above.

i. For every 10 field samples collected, take one additional sample (a field duplicate) for quality control purposes. Attachment 1 provides a 10% allowance for these additional analyses. Duplicates shall be indistinguishable from other analytical samples so personnel performing the analyses are not able to determine which samples are duplicates.

j. For every 20 field water samples collected, prepare and submit for analysis one additional field blank for all parameters analyzed in water. A minimum of one field blank for each parameter is required. Allowances for these additional analyses are included in Attachment 1.

k. Maintain chain-of-custody records for all samples, field blanks, and quality control samples.

10. Chemical Analyses

a. Analyze water and soil samples collected as specified in Section B below, Specific Site Work. The analytical parameters are summarized in Attachment 1 along with the required methods. Archive all raw data, including QA/QC and standards data for not less than five years after project completion. Supply this data to the USAFOEHL/TS upon request.

b. All analyses shall meet the required limits of detection for the applicable method identified in Attachment 1.

c. For those methods which employ gas chromatography (GC) as the analytical technique (E601, SW8010 and SW8020) positive confirmation of identity is required for all analytes having concentrations higher than the Method Detection Limit (MDL). Conduct positive confirmation by second-column GC; however, gas chromatography/mass spectroscopy (GC/MS) can be used for positive confirmation if the quantity of each analyte to be confirmed is above the detection level of the GC/MS instrument. Analytes which cannot be confirmed will be reported as "Not Detected" in the body of the report, but results of all second-column GC or GC/MS confirmational analyses are to be included in the report appendix along with other raw analytical data. Base the quantification of confirmed analytes upon the first column analysis. The maximum number of second-column confirmational analyses shall not exceed fifty percent (50%) of the actual number of field samples (to include duplicates). The total number of samples for each GC method listed in Attachment 1 includes this allowance. If GC/MS, or a combination of second-column GC and GC/MS, is used, the total cost of all such analyses for a particular parameter shall not exceed the funding allowed for positive confirmation using only second-column GC.

d. All chemical/physical analyses shall conform to state and other applicable Federal and local regulatory agency legal requirements. If a regulatory agency specifies that a type of analysis be performed in a certified laboratory, assure compliance with the requirement and furnish documentation showing laboratory certification with the first analytical data supplied to the USAFOEHL.

11. Decontamination Procedures:

a. Decontaminate all sampling equipment, including internal components, prior to use and between samples to avoid cross contamination. Wash equipment with a laboratory-grade detergent followed by drinking quality water, solvent (methanol), and distilled water rinses. Allow sufficient time for the solvent to evaporate and the equipment to dry completely.

b. Dedicate for each well the monofilament line or steel wire used to lower sampling equipment into the well; do not use a line in more than one well. Decontaminate the calibrated water level probe for measuring well volume and water level elevation before use in each well.

c. Thoroughly clean and decontaminate the drilling rig and tools before initial use and after each borehole completion. As a minimum, steam clean drill bits after each borehole is installed. Drill from the "least" to the "most" contaminated areas, if possible.

12. Conduct a literature search of local hydrogeologic conditions to complement the Phase I Report (mailed under separate cover). Use this data to determine optimum well locations. Include the pertinent literature search information in an appendix of the Final Report. Develop the literature search data using the following guideline:

a. Topographic data

b. Geologic data

(1) Structure

(2) Stratigraphy

(3) Lithology

c. Hydrogeologic data

(1) Location of all existing and abandoned wells, including observation wells, and springs, natural ponds and seepages, that occur on or off the installation within a one-mile radius of sites to be investigated

(2) Groundwater table and piezometric contours

(3) Depth to groundwater

(4) Surface and groundwater quality

(5) Recharge, discharge and contributing areas

(6) Geologic setting, yield and hydrographs of springs and natural seepages

d. Data on all existing and abandoned wells, to include observation holes,on or off the installation and within a one-mile radius of sites to be investigated.

(1) Location, depth, diameter, types of wells, and logs

(2) Static and pumping water levels, hydrographs, yield and specific capacity

(3) Present and projected groundwater development and use

(4) Corrosion, incrustation, well interference, and similar operation and maintenance problems

(5) Observation well networks

(6) Existing water sampling sites

e. Aquifer data

(1) Type, such as unconfined, artesian, or perched

(2) Thickness, depths, and formational designation

(3) Boundaries

(4) Transmissivity, storativity, and permeability

(5) Specific retention

(6) Discharge and recharge

(7) Ground and surface water relationships

(8) Aquifer models

f. Climatic data

(1) Precipitation (total and net)

(2) Evapotranspiration

B. Specific Site Work

Attachment 3 is a base map showing the site locations. In addition to items delineated in I.A. above, conduct the following specific actions at the sites listed below:

1. Sanitary Landfill

a. Install nine shallow (approximately 20 feet deep) wells around the perimeter of the landfill. Approximately locate the wells (SW 1, 2, 3, 4, 5, 6, 7, 8 and 9) as shown on Attachment 4.

b. Perform three soil borings to a depth of 100 feet to determine lithology and geology around the landfill. Grout the lower 50 feet of each boring with a bentonite/cement grout and convert the boreholes to deep (approximately 50 feet) wells. Screen a maximum of 10 feet of the deep wells. Approximately locate the wells (DW 1, 2, and 3) as shown on Attachment 4 and as follows:

(1) One well collocated with the shallow well installed on the north edge of landfill.

(2) One well collocated with the shallow well on the east edge of the landfill in the drainage channel.

(3) One well collocated with the shallow well installed between the sewage lagoon and the landfill.

c. Collect a groundwater sample from each of the 12 new wells and from the four existing groundwater monitoring wells in the landfill (16 water samples).

d. Collect a maximum of four surface water samples from any standing water in the landfill or from the landfill drainage channel which flows off base. If the water is flowing in the drainage channel, take a discharge measurement.

e. Analyze water samples for petroleum hydrocarbons, aromatic volatile organics, halogenated volatile organics, 13 priority pollutant metals, extractable priority organic pollutants (GC/MS), total dissolved solids (TDS), and common anions.

2. Firefighter Training Area (FTA).

a. Install four wells (approximately 30 feet deep) equally spaced around the perimeter of the FTA.

b. Perform one soil boring in the center of the fire training area to a depth of 30 feet. Collect four soil samples for chemical analysis from the boring, based on HNU or OVA meter readings, odor, discoloration or other indicators of contamination.

c. Collect three sediment samples for chemical analysis in the ditch draining the FTA. Take samples to a depth of one foot at the following locations: the effluent side of the culvert in the ditch near the FTA, just inside the base boundary where the ditch leaves the base, and at a point of suspected contamination selected in the field.

d. Collect a groundwater sample from each well.

e. Analyze those soil/sediment samples selected for chemical analysis for petroleum hydrocarbons, aromatic volatile organics, halogenated volatile organics, and lead.

f. Analyze water samples for petroleum hydrocarbons, aromatic volatile organics, halogenated volatile organics, and lead.

3. Explosive Ordnance Disposal (EOD) Area.

a. Perform one 20 foot soil boring in a location specified by the Base POC. Collect two soil samples during boring based on HNU or OVA meter readings, odor, discoloration or other indicators of contamination.

b. Analyze the soil samples for petroleum hydrocarbons and 13 priority pollutant metals.

4. Background Sampling

a. To determine background water quality, sample the existing Corps of Engineers well once. Analyze the sample for halogenated and aromatic

volatile organics, petroleum hydrocarbons, 13 priority pollutant metals, total dissolved solids, and common anions.

C. Health and Safety

Comply with USAF, OSHA, EPA, state and local health and safety regulations regarding the proposed work effort. Use EPA guidelines for designating the appropriate levels of protection at study sites. Prepare a written Health and Safety Plan for the proposed work effort and coordinate it directly with applicable regulatory agencies prior to commencing field operations. Provide an information copy of the Health and Safety Plan to the USAFOEHL after coordination with regulatory agencies. The Health and Safety Plan is specified in Sequence No. 7, Item VI below.

D. Technical Operations Plan

Immediately after the Notice To Proceed (NTP) for the delivery order, develop a Technical Operations Plan (TOP) based on the technical requirements specified in this task description. (See Sequence No. 20, Item VI, below). Follow the TOP format (mailed under separate cover). Provide the TOP to the USAFOEHL within two weeks of the NTP.

E. Data Review

1. Tabulate field and analytical laboratory results, including field and laboratory parameters and QA/QC data, as they become available and incorporate them into the next monthly R&D Status Report (Sequence No. 1, Item VI below) forwarded to the USAFOEHL. In addition to the results, report the following:

a. the time and dates for sample collection, extraction (if applicable) and analysis;

b. the method used and Method Detection Limits achieved;

c. the Chain-of-Custody forms;

d. a cross-reference of laboratory sample numbers to field sample numbers; and

e. a cross-reference of field sample numbers to wells, boreholes, sites, etc.

2. Upon completion of all analyses, tabulate and incorporate all results into an Informal Technical Information Report (Sequence No. 3, Item VI, below) and forward the report to USAFOEHL for review a minimum of two weeks prior to submission of the draft report. Provide as a minimum the information specified in I.E.1. above.

3. Immediately report to the USAFOEHL Program Manager or his supervisor via telephone, data/results generated during this investigation which indicate a potential health risk (for example, a contaminated drinking

water aquifer). Follow the telephone notification with a written notice within three days; attach a copy of the laboratory raw data (i.e., chromatogram).

F. Reporting

1. Prepare a draft report delineating all findings of this field investigation and forward it to the USAFOEHL (as specified in Sequence No. 4, Item VI, below) for Air Force review and comment. Strictly adhere to the USAFOEHL report format (mailed under separate cover). The format is an integral part of this delivery order. Draft reports are considered "drafts" only in the sense that they have not been reviewed and approved by Air Force officials. In all other respects, "drafts" must be complete, in the proper format, and free of grammatical and typographical errors. Include a discussion of the regional/site specific hydrogeology, well and boring logs, data from water level surveys, ground water surface and gradient maps, water quality and soil analysis results, available geohydrologic cross sections, and laboratory and field QA/QC information. Follow the USAFOEHL supplied format (mailed under separate cover). For states requiring the field work or technical effort be supervised by a state registered geologist, engineering geologist or professional engineer, insert this information in the report to include registration numbers, certificate and seals (as appropriate).

2. Review the IRP Phase I report. Integrate the Phase I information with the investigative work done at each site to date so the report reflects the total cumulative information for each site studied in this effort.

3. In the results section, include water and soil analyses results and field quality control sample data. Report all internal laboratory quality control data (lab blanks, lab spikes, and lab duplicates), and laboratory quality assurance information in an appendix of the report. Provide second-column confirmation results and quantities, and include which columns were used, instrument operating conditions and retention times. Summarize in the appendix the specific collection technique, analytical method (Standard Methods, EPA, etc.), holding time, and limit of detection for each analyte.

4. Make estimates of the magnitude, extent and direction which detected contaminants are moving. Identify potential environmental consequences of discovered contamination based upon state or Federal standards.

5. Plot and map all field data collected for each site according to surveyed positions.

6. In the recommendation section, address each site and list them by category:

a. Category I consists of sites where no further action (including remedial action) is required. Data for these sites are considered sufficient to rule out unacceptable public health or environmental hazards.

b. Category II sites are those requiring an additional Phase II effort to determine the direction, magnitude, rate of movement and extent of detected contaminants. Identify potential environmental consequences of discovered contamination, where known.

c. Category III sites are those that will require remedial actions (ready for IRP Phase IV). In the recommendations for Category III sites, include any possible influence on sites in Categories I and/or II due to their connection with the same hydrological system. Clearly state any dependency between sites in different categories. Include a list of candidate remedial action alternatives, including Long Term Monitoring (LTM) as remedial action, and the corresponding rationale that should be considered in selecting the remedial action for a given site. List all alternatives that could potentially bring the site into compliance with environmental standards. For contaminants that do not have standards, EPA recommended safe levels for noncarcinogens (Health Advisory or Suggested-No-Adverse-Response Levels) and target levels for carcinogens (1×10^{-6} cancer risk level) may be used. Unless specifically requested, do not perform comprehensive cost analyses, or cost/benefit review for remedial action alternatives. However, in those situations where field survey data indicate immediate corrective action is necessary, present specific, detailed recommendations.

For each category above, summarize the results of field data, environmental or regulatory criteria, or other pertinent information supporting conclusions and recommendations.

7. Provide cost estimates by line item for future efforts recommended for Category II sites and LTM Category III sites. Submit these estimates concurrently with the approved Final Report in a separate document. Only the cost requirements outlined in Sequence No. 2, Item VI, need be submitted.

a. For Category II sites, develop detailed site-specific estimates using prioritized costing format (i.e., cost of conducting the required work on: the highest priority site only; the first two highest priority sites only; the first three highest priority sites only; etc., until all required work is discretely costed) for the proposed work effort. The Air Force determines the priority of sites from contractor recommendations. Consider the type of contaminants, their magnitude, the direction and rate of their migration, and their subsequent potential for environmental and health consequences when developing recommendations for site prioritization.

b. For Category III sites slated for long-term monitoring, develop site-specific estimates which detail the costs associated with: (1) permanent installation of monitoring wells; (2) ground water sampling interface equipment, including permanent installations of pumps and sampling lines; and (3) four quarterly (1 year period) sample collections and laboratory chemical analyses of ground water, etc.

8. Provide an inventory of all on-base wells, to include production, irrigation, monitoring, etc. If the well has been abandoned, then state the reason.

9. Reference in an appendix any local, state and/or Federal regulations which require specific well drilling techniques, materials, well development, purging, and sampling methods for work specified in this effort.

G. Meetings

The contractor's project leader shall attend three meeting(s) to take place at a time to be specified by the USAFOEHL. Each meeting shall take place at Minot AFB for a duration of one eight-hour day.

II. SITE LOCATION AND DATES:

Minot AFB ND
Date to be established

III. BASE SUPPORT:

A. Prior to any contractor digging or drilling, the Base Civil Engineer POC will locate underground utilities and issue digging permits..

B. The Base Civil Engineer will assign accumulation points within the installation for the contractor to use to deliver any drill cuttings or well installation/development fluids generated from the required work which are suspected to be hazardous.

C. The Base Civil Engineer will take custody of any drill cuttings or well installation/development fluids suspected to be hazardous and properly dispose of the material according to applicable state/Federal regulations.

D. The Base will provide the contractor with existing engineering plans, drawings, diagrams, aerial photographs, etc., to evaluate sites under investigation.

E. The Base POC will select 10% of the split samples provided by the contractor, package them, and ensure they are picked up by the contractor within 24 hours of sample receipt by the POC. See paragraph I.A.9.h.

F. The Base will arrange for and have available prior to the start-up of field work, the following services, materials, work space, and items of equipment to support the contractor conducting the survey:

1. Personnel identification badges and vehicle passes and/or entry permits.

2. A staging area for storage of equipment and supplies.

3. A supply (i.e., fire hydrant) for large quantities (up to a maximum of 1,000 gallons) of potable water to be used in equipment cleaning, etc.

4. A household-type refrigerator having approximately two cubic feet of freezer space for storage of blue ice.

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

1. USAFOEHL Program Monitor

Capt Patrick N. Johnson
USAFOEHL/TSS
Brooks AFB TX 78235-5501
(512) 536-2158
AV 240-2158/2159
1-800-821-4528

2. Base Point of Contact (POC)

Capt David DeMay
USAF Regional Hosp Minot/SGPB
Minot AFB ND 58705-5300
(701) 727-3398
AV 344-3398

3. MAJCOM Monitor

Lt Col John Pontier
HQ SAC/SGPB
Offutt AFB NE 68113-5001
(402) 294-4651
AV 271-4651

4. Base Civil Engineer POC

Mr John L. Boucher
91st CSG/DEEVE
Minot AFB ND 58705-5300
(701) 727-3691
AV 344-3691

VI. In addition to sequence numbers 1, 5 and 11 listed in Attachment 1 to the contract, and which apply to all orders, the sequence numbers listed below are applicable to this order. Also shown are dates applicable to this order.

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
20 (TOP)*	I.D.	OTIME	86SEP26	86SEP29		15
7 (Health & Safety)	I.C.	OTIME	86SEP26	86SEP27		3
3 (Prelim Data)	I.E.2	OTIME	**	**		3
4 (Tech. Rpt)	I.F.	ONE/R	87JAN30	87FEB13	87NOV13	***
2 (Cost Data)	I.F.7.	OTIME	87FEB13	87NOV13		****
14		MONTHLY	86OCT14	86OCT31	*****	3
15		MONTHLY	86OCT14	86OCT31	*****	3

*The Technical Operations Plans (TOP) required for this stage is due within two (2) weeks of the Notice to Proceed (NTP).

**Upon completion of the total analytical effort before submission of the first draft report.

***Two draft reports (25 copies of each) and one final report (50 copies plus the original camera ready copy) are required. Incorporate Air Force commends into the second draft and final reports as specified by the USAFOEHL. Supply the USAFOEHL with an advance copy of the first draft, second draft, and final reports for acceptance prior to distribution. Distribute remaining 24 copies of each draft report and 49 copies of the final report as specified by the USAFOEHL.

****Submit cost estimates (five copies) in a separately bound document with the Final Report only. Provide estimates for only those sites recommended for additional Phase II work (Category II) or Phase IV, Long Term Monitoring, (Category III).

*****Submit monthly hereafter.

Attachment 1

Analytical Methods, Detection Limits, and Number of Samples

PARAMETER	METHOD	DETECTION LIMIT[h]	NO. OF SAMPLES	QA[i]	TOTAL SAMPLES
Halogenated Volatile Organics	SW5030/SW8010	a	7 soil	1 soil	12 soil[d]
	EPA 601	a	25 water	4 water	45 water[e]
Aromatic Volatile Organics	SW5030/8020	a	7 soil	1 soil	12 soil[f]
	SW5030/8020	a	25 water	4 water	45 water[g]
Extractable Priority Pollutants (GC/MS)	EPA 625	a	20 water	3 water	23 water
Petroleum Hydrocarbons	SW3550/EPA 418.1	1 mg/kg	9 soil	1 soil	10 soil
	EPA 418.1	1 mg/L, water	50 water	8 water	58 water
Total Dissolved Solids (TDS)	EPA 160.1	10 mg/L, water	21 water	3 water	24 water
Priority Pollutant Metals (13 ea.)	EPA 200.7	c	21 water	3 water	24 water
	SW 3050/SW6010	c	2 soil	1 soil	3 soil
	EPA 245.1 (Hg)	c	21 water	3 water	24 water
	SW7471 (Hg)	c	2 soil	1 soil	3 soil
	EPA 206.2 (As)	c	21 water	3 water	24 water
	SW3050/SW7060(As)	c	2 soil	1 soil	3 soil
	EPA 270.2 (Se)	c	21 water	3 water	24 water
	SW3050/SW7740(Se)	c	2 soil	1 soil	3 soil
Lead	SW3050/7420	10 mg/kg	7 soil	1 soil	8 soil
	E239.2	0.002 mg/L	4 water	2 water	6 water
Common Anions	A429	0.1 mg/L	21 water	3 water	24 water
pH (Field Test)	--	--	25 water	--	25 water
Temperature (Field Test)	--	--	25 water	--	25 water
Conductance (Field Test)	--	--	25 water	--	25 water
Ep Toxicity (Metals)	SW Manual	b	10 soil	3 soil	13 soil

a. Detection limits as specified by the applicable EPA or Standard Method; report results in µg/L for water samples and mg/kg for soil samples.

b.

Metal	mg/L leaching solution
As	0.002
Ba	0.1
Cd	0.005
Cr	0.05
Pb	0.1
Hg	0.0002
Se	0.002
Ag	0.01

c.

Metal	DETECTION LIMIT Water(mg/L)	Soil/Sediment(mg/kg)
Sb	0.032	3.2
As	0.001	0.1
Be	0.0003	0.03
Cd	0.004	0.4
Cr	0.007	0.7
Cu	0.006	0.6
Pb	0.042	4.2
Hg	0.0002	0.1
Ni	0.015	1.5
Se	0.002	0.2
Ag	0.007	0.7
Tl	0.040	4.0
Zn	0.002	0.2

d. Total of 12 includes second column confirmation for 50% of the samples (4).

e. Total of 45 includes second column confirmation for 50% of the samples (15).

f. Total of 12 includes second column confirmation of 50% of the samples (4).

g. Total of 45 includes second column confirmation of 50% of the samples (15).

h. Report results of all soil sample analyses as mg/kg of dry soil. Report the soil moisture content of each sample.

i. QA includes a 10% increase for field duplicates and a 5% increase for field blanks (water samples only).

Attachment 2

Sampling and Analytical Requirements
Minot AFB SD
Soil

	Halogenated Volatile Organics	Aromatic Volatile Organics	Petroleum Hydrocarbons	Priority Pollutant Metals (13 ea)	Lead
FTA	7	7	7		7
EOD			2	2	
Total	7	7	9	2	7

Attachment 2

Sampling and Analytical Requirements
Minot AFB SD
Water

	Halogenated Volatile Organics	Aromatic Volatile Organics	Extractable Priority Pollutants (GC/MS)	Petroleum Hydrocarbons	Total Dissolved Solids	Priority Pollutant Metals (13 ea)	Lead	Common Anions	pH	Temperature	Conductance
Sanitary Landfill	20	20	20	40	20	20		20	20	20	20
FTA	4	4		8			4		4	4	4
C/E Well	1	1		2	1	1		1	1	1	1
Total	25	25	20	50	21	21	4	21	25	25	25

APPENDIX C

WELL NUMBERING SYSTEM

(CL5060B/0528N)

C. Well Numbering System

A well numbering system was used to identify each well constructed during the on-site remedial investigation. A unique number was assigned to each well and listing of well numbers was maintained by the HART field team leader. The system is described below.

Well Identification

Each well was identified by a two-letter identifier code, with the following prefix:

SW - Shallow Well (less than 30 feet in depth)

DW - Deep Well (greater than 30 feet in depth)

A numerical suffix unique to each prefix follows.

Example

SW-1. Shallow monitoring well No. 1.

APPENDIX D

GEOLOGICAL LOGS

(CL5060B/0528N)

APPENDIX D.1

HART TEST BORING LOGS

(CL5060B/0528N)

PROJECT NAME: LSAF-MAFB
DATE DRILLED: 10/15/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Holow Flight Auger

PROJECT NUMBER: 0107-00
BORING NUMBER: GW1
BOREHOLE GRND ELEV.: 1620.79
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-1

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. In.	O.V.A. ppm	Feet	Visual Classification
DW2-1	0	2	SS	1, 2, 5, 12	0.9	0	1	[ML] 0 -0.6: organic topsoil. 0.6 -0.9: gray silty clay.
DW2-2	2	4	SS	2, 1, 4, 4	1.0	0	2	0 -0.6: sandy fill;
							3	0.6 -1.0: brown-gray silty clay.
DW2-3	4	6	SS	1, 2, 2, 4	1.2	0	4	Gray-brown mottled silty clay with trace of sand
							5	and organic matter.
DW2-4	6	8	SS	2, 3, 8, 12	1.8	0	6	0 -1.5: gray-brn silty clay;
							7	1.5 -1.8: lt. brown sand and gravel with trace of silt.
DW2-5	8	10	SS	4, 4, 5, 6	2.0	0	8	Brown sandy silt;
							9	lens of med. to fn. ---- at 0.2.
DW2-6	10	12	SS	2, 2, 9, 10	.7	0	10	0 -0.6: brown sandy silt;
							11	0.6 -.7: fn. to med. orange-brown sand with trace of silt, crs. sand and gravel.
DW2-7	12	14	SS	4, 3, 4, 5	1.0	0	12	0 -0.7: orange-brown sand.
							13	[CL] 0.7 -1.0: dark gray silty clay w/ trace sand & pebbles.
DW2-8	14	16	SS	2, 3, 4, 6	1.2	0	14	Dark gray silty clay with trace of sand and pebbles.
							15	
DW2-9	16	18	SS	3, 4, 7, 11	1.0	0	16	Same as above (some silty fine sand at bottom of ----
							17	
DW2-10	18	20	SS	8, 10, 17, 15	1.0	0	18	0 -0.4: dk. gray silty clay;
							19	0.4 -1.0: gray, fine silty sand.
							20	

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/9/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW3
BOREHOLE GRND ELEV.: 1638.07 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-3

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
SW3-1	0	2	SS	2, 3	0.5	0		[ML] Brown to dark brown topsoil.
				4			1	
				4				
							2	
							3	
							4	
SW3-2	5	7	SS	4	1.8	0	5	Brown silty clay, with occasional orange mottling and pebbles.
				5				
				8			6	
				12				
							7	
							8	
							9	
SW3-3	10	12	SS	4	1.6	0	10	Same as above.
				11				
				17			11	
				20				
							12	
							13	
							14	
SW3-4	15	17	SS	8	2.0	0	15	Same as above.
				9				
				12			16	
				15				
							17	
							18	
							19	
SW3-5	20	22	SS	6	2.0	0	20	Same as above, with more gravel.
				10				
				12			21	
				18				
SW3-6	22	24	SS	7	NM	0	22	Same clay as above, with occasional sand lenses.
				12				

Log Continued on Next Page

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/9/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW3
BOREHOLE GRND ELEV.: 1638.07 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-3

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.			O.V.A. ppm	Feet	Visual Classification
				17					23	
				25						
									24	
									25	

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/17/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : B. Macke/ J Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW5
BOREHOLE GRND ELEV.: 1632.54 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-5

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
SW5-1	0	2	SS	4, 12	1.5	0		[ML] 0 -0.6: dark brown topsoil.
				14			1	0.6 -1.5: gray, medium sand and gravel.
				14				
SW5-2	2	4	SS	6	1.3	0	2	0 -1.2: brown, medium to coarse sand and pebbles.
				6				
				4			3	1.2 -1.3: lt. gray clayey silt.
				4				
SW5-3	4	6	SS	3	1.6	0	4	0-0.1:brn silt; 0.2-0.3:brn
				6				silty sand; 0.3-0.7:brn silty
				5			5	clay; 0.7-0.9:fn silty sand;
				7				0.9-1.6: sandy silt.
SW5-4	6	8	SS	2	2.0	0	6	Lt gray silty clay with
				5				orange mottling, trace
				6			7	of pebbles and a few micro-
				11				sand lenses.
SW5-5	8	10	SS	5	1.8	0	8	0 -0.2: same clay as above;
				4				0.2 -0.7: fn. brn. sand with
				6			9	trace of silt; 0.7 -1.8: brn.
				9				slt clay w/ tr sand & pebbles
SW5-6	10	12	SS	3	2.0	0	10	Same clay as above.
				4				
				6			11	
				10				
SW5-7	12	14	SS	3	2.0	0	12	0 -0.7: fn brown sand with
				4				little silt.
				7			13	0.7 -2.0: brown silty clay.
				8				
SW5-8	14	16	SS	3	2.0	0	14	[CL] Dark brown to gray silty
				7				clay with trace of sand
				8			15	and pebbles.
				13				
SW5-9	16	18	SS	4	2.0	0	16	Same as above.
				6				
				8			17	
				12				
							18	

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/16/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : B. Macke/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW6
BOREHOLE GRND ELEV.: 1643.41 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-6

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
SW6-1	0	2	SS	2, 7	0.5	0		[ML] Dark brown to black topsoil.
				6			1	(hit rock)
				17				
SW6-2	2	4	SS	2	1.1	0	2	0 -0.7: same as above.
				1				0.7 -1.1: dark brown clayey
				2			3	silt with root material.
				3				
SW6-3	4	6	SS	1	1.3	0	4	0 -0.5: same as above.
				1				0.5 -1.3: lt. gray clay with
				2			5	trace of silt.
				3				
SW6-4	6	8	SS	2	1.6	0	6	Same clay as above; a
				2				white, medium to coarse sand
				4			7	lens at 1.5.
				6				
SW6-5	8	10	SS	3	2.0	0	8	Medium gray clay with little
				4				silt and sand.
				5			9	
				8				
SW6-6	10	12	SS	2	2.0	0	10	Same as above.
				5				
				8			11	
				10				
SW6-7	12	14	SS	4	1.6	0.5	12	Same as above with traces of
				5				lignite and orange mottling
				10			13	in places.
				12				
SW6-8	14	16	SS	4	2.0	0	14	Same clay as above.
				7				
				10			15	
				12				
SW6-9	16	18	SS	3	2.0	0	16	Same clay as above with more
				6				silt in places.
				9			17	
				14				
SW6-10	18	20	SS	5	2.0	0	18	[CL] Dark gray silty clay with
				8				trace of sand and pebbles.
				12			19	
				13				
							20	
							21	
							22	

Log Continued on Next Page

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/16/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : B. Macke/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW6
BOREHOLE GRND ELEV.: 1643.41 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-6

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
SW6-11	23	25	SS	5	2.0	0	23	Dark gray silty clay with trace of sand and pebbles.
				8				
				8			24	
				10				
							25	
							26	
							27	
SW6-12	28	30	SS	7	2.0	0	28	Same as above.
				10				
				10			29	
				11				
							30	
							31	
							32	
SW6-13	33	35	SS	2	1.8	0	33	Same as above.
				6				
				8			34	
				11				
							35	
							36	
							37	
SW6-14	38	40	SS	3	2.0	0	38	Same as above.
				8				
				8			39	
				13				
							40	
							41	
							42	
SW6-15	43	45	SS	4	1.6	0	43	Same as above.
				9				
				12			44	
				14				
							45	

Log Continued on Next Page

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/16/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : B. Macke/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW6
BOREHOLE GRND ELEV.: 1643.41 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-6

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
							46	
							47	
SW6-16	48	50	SS	5	2.0	0	48	Same as above; 1.7 -2.0: dark brown to black, medium to coarse sand with some lignite.
				11			49	
				10				
				21			50	

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/22/86
DRILLING LOCATION : F.T.A.
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW7
BOREHOLE GRND ELEV.: Not Surveyed
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: None

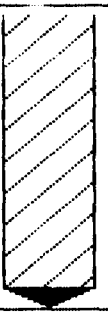
Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
SW7-1	0	2	SS	3, 5	0.8	0	1	[ML] 0 -0.5: dk brn silty topsoil; 0.5 -0.8: lt brn silty clay.
				4				
				5			2	
							3	
							4	
SW7-2	5	7	SS	2	0.9	25	5	Brn silty clay with trace of sand and pebbles and small (<.1') lenses of fn. to med. sand; sand, and in some cases clay, is stained black & has a distictive odor.
				3				
				6			6	
				8			7	
							8	
							9	
SW7-3	10	12	SS	2	1.8	300	10	Same (clay & sand) as above; sand is at 1.6; sample has same discoloration and odor as above.
				3				
				6			11	
				8			12	
							13	
							14	
SW7-4	15	17	SS	3	2.0	0	15	Brown silty clay with trace of sand and pebbles.
				5				
				5			16	
				8			17	
							18	
							19	
SW7-5	20	22	SS	2	2.0	0	20	[CL] Dark gray silty clay with trace of sand and pebbles.
				2				
				5			21	
				6				
							22	

Log Continued on Next Page

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/22/86
DRILLING LOCATION : F.T.A.
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW7
BOREHOLE GRND ELEV.: Not Surveyed
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: None

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
							23	
							24	
SW7-6	25	27	SS	3	1.8	0	25	Same as above.
				6			26	
				7				
				8			27	



PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/23/86
DRILLING LOCATION : F.T.A.
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW8
BOREHOLE GRND ELEV.: 1651.33 ft. asl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-8

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
SW8-1	0	2	SS	3, 5	0.8	0		[ML] Lt. to dk. brown silty topsoil with trace of pebbles and organic matter.
				4			1	
				5				
							2	
							3	
							4	
SW8-2	5	7	SS	2	1.4	NM	5	Lt. brown silty clay with trace of sand and pebbles.
				4				
				4			6	
				7				
SW8-3	7	9	SS	3	2.0	NM	7	Same as above.
				5				
				5			8	
				8				
SW8-4	9	11	SS	5	2.0	NM	9	Same as above.
				5				
				8			10	
				12				
SW8-5	11	13	SS	4	1.0	NM	11	Same as above with some orange mottling.
				6				
				8			12	
				11				
SW8-6	13	15	SS	4	2.0	NM	13	Lt. brown silty clay with trace of sand and pebbles.
				5				
				9			14	
				11				
SW8-7	15	17	SS	5	2.0	NM	15	0 -1.0: same as above; 1.0 -2.0: clay is grading to a gray clay.
				8				
				12			16	
				16				
SW8-8	17	19	SS	4	2.0	NM	17	Gray silty clay with trace of sand and pebbles and orange mottling.
				7				
				8			18	
				12				
SW8-9	19	21	SS	3	2.0	NM	19	[CL] Dk. gray silty clay with trace of sand and pebbles.
				6				
				9			20	
				10				
							21	
							22	

Log Continued on Next Page

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/23/86
DRILLING LOCATION : F.T.A.
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW8
BOREHOLE GRND ELEV.: 1651.33 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-8

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
							23	
SW8-10	24	26	SS	4 7 9 10	2.0	NM	24 25 26 27	Same as above.
SW8-11	28	30	SS	4 6 7 10	2.0	NM	28 29 30	Same as above.

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/23/86
DRILLING LOCATION : F.T.A.
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW9
BOREHOLE GRND ELEV.: 1650.22 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-9

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
SW9-1	0	2	SS	4, 10	1.5	0		[ML] 0 -0.5: dk brn silty topsoil;
				9			1	0.5 -1.5: lt brn silty clay
				7				with trace of sand & pebbles;
							2	lens of fine, brown sand
								from 0.8 -1.0.
							3	
							4	
SW9-2	5	7	SS	2	1.5	>1000	5	Lt. brown silty clay with
				4				trace of sand and pebbles; 1
				4			6	cobble and tip of spoon
				6				had black stained sand.
SW9-3	7	9	SS	2	1.9	800	7	Same (silty clay) as above;
				4				sand increases from trace
				5			8	to some in patchy areas.
				8				
SW9-4	9	11	SS	4	2.0	>1000	9	Same as above.
				4				
				6			10	
				9				
SW9-5	11	13	SS	6	2.0	90	11	Same as above with more
				9				cobbles.
				12			12	
				27				
SW9-6	13	15	SS	4	2.0	1-2	13	Lt. brn. fn. silty sand with
				4				silty clay layers at 1.25 to
				5			14	1.4 and 1.85 to 1.9.
				7				
SW9-7	15	17	SS	3	2.0	3	15	Non-uniform alternating of
				4				silty fine sands and silty
				5			16	clays with pebbles and 1
				13				large cobble.
SW9-8	17	19	SS	6	1.6	9	17	Lt. brown, silty, fine sands
				8				with some pebbles & cobbles.
				14			18	
				14				
SW9-9	19	21	SS	7	2.0	0	19	0 -0.4: fn. to med. silty brn.
				5				sand with some pebbles;
				5			20	0.4 -2.0: brn. silty clay
				6				with some sand and pebbles.
SW9-10	21	23	SS	3	1.5	0	21	Lt. brown to gray silty clay
				4				with some sand and trace of
				7			22	pebbles.
				7				

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PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/23/86
DRILLING LOCATION : F.T.A.
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: SW9
BOREHOLE GRND ELEV.: 1650.22 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-9

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
SW9-11	23	25	SS	4	2	7-8	23	[CL] Dark gray silty clay with trace of sand and pebbles.
				6				
				12			24	
				13				
							25	

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/7-8/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Mud Rotory

PROJECT NUMBER: 01071-00
BORING NUMBER: DW1(see note on D.1-18)
BOREHOLE GRND ELEV.: 1632.21 ft msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-1, SW-2

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
DW1-1	0	2	SS	2, 3	0.7	0		[ML] Gray-tan silty clay
				4			1	with black organic layer
				6				from 0.2 -0.4
							2	
							3	
							4	
DW1-2	5	7	SS	3	1.7	0	5	Light brown to gray silty
				4				clay; mottled.
				5			6	
				7				
							7	
							8	
							9	
DW1-3	10	12	SS	5	1.7	0	10	Brown silty clay with
				6				orange mottling; slightly
				13			11	moist; trace of
				12				pebbles (<1/4").
							12	
							13	
							14	
DW1-4	15	17	SS	5	2.0	0	15	[CL] Dark gray silty clay with
				7				minor orange mottling and
				10			16	trace of large pebbles
				12				(>1").
							17	
							18	
							19	
DW1-5	20	22	SS	3	1.5	0	20	Same as above; trace of sand
				6				and pebbles.
				9			21	
				11				
							22	

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PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/7-8/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Mud Rotory

PROJECT NUMBER: 01071-00
BORING NUMBER: DW1 (see note on D.1-18)
BOREHOLE GRND ELEV.: 1632.21 ft msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-1, SW-2

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
							23	
							24	
DW1-6	25	27	SS	4	1.5	0	25	Same as above.
				6				
				8			26	
				11				
							27	
							28	
							29	
DW1-7	30	32	SS	4	1.5	0	30	Same as above.
				7				
				11			31	
				14				
							32	Drillers believe they hit "sand and gravel" layers
							33	between 32' and 35'
							34	
DW1-8	35	37	SS	5	1.6	0	35	Same as above; trace of
				9				lignite fragments.
				14			36	
				16				
							37	
							38	
							39	
DW1-9	40	42	SS	5	1.4	0	40	Same as above with a med.
				8				to crs., poorly sorted sand
				13			41	lens from 0.8 -0.9.
				17				
							42	
							43	
							44	
DW1-10	45	47	SS	8	0.8	0	45	Same as above.

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PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/7-8/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Mud Rotory

PROJECT NUMBER: 01071-00
BORING NUMBER: DW1 (see note on D.1-18)
BOREHOLE GRND ELEV.: 1632.21 ft msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-1, SW-2

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
				11				
				14			46	
				18				
							47	
							48	
							49	
DW1-11	50	52	SS	9	1.6	0	50	Same as above to 50.8';
				27				change to silty fine sand,
				28			51	slightly moist to moist.
				24				
							52	
							53	
							54	
DW1-12	55	57	SS	8	1.5	0	55	Dark gray silty clay with
				13				trace of sand and pebbles;
				23			56	alternating fine sand and
				25				clay from 0.5 -1.5.
							57	
							58	
							59	
DW1-13	60	62	SS	6	1.4	0	60	Dark gray silty clay with
				9				trace of lignite.
				13			61	
				21				
							62	
							63	
							64	
DW1-14	65	67	SS	9	2.0	0	65	Dark gray silty clay to 66';
				19				changes to coarse, wet
				32			66	sand.
				30				
							67	

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PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/7-8/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Mud Rotory

PROJECT NUMBER: 01071-00
BORING NUMBER: DW1(see note on D.1-18)
BOREHOLE GRND ELEV.: 1632.21 ft msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-1, SW-2

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
							68	
							69	
DW1-15	70	72	SS	12	0.8	0	70	Dark gray silty clay changes to fine sand (saturated).
				17				
				23			71	
				25				
							72	
							73	
							74	
DW1-16	75	77	SS	7	1.0	0	75	Dark gray silty clay; very dense.
				11				
				15			76	
				21				
							77	
							78	
							79	
DW1-17	80	82	SS	5	0.5	0	80	Same as above.
				10				
				15			81	
				19				
							82	
							83	
							84	
DW1-18	85	87	SS	6	1.7	0	85	Same as above.
				10				
				15			86	
				18				
							87	

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PROJECT NAME: USAF-HAPB
DATE DRILLED: 10/7-8/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Mud Rotory

PROJECT NUMBER: 01071-00
BORING NUMBER: DW1*
BOREHOLE GRND ELEV.: 1632.21
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW1, SW2

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
							88	(CL)
							89	
DW1-19	90	92	SS	6	0.6	0	90	Same as above.
				9				
				14			91	
				32				
							92	
							93	
							94	
DW1-20	95	97	SS	37	1.2	0	95	Silty fine sand to sandy silt.
				54				
				46			96	
							97	

* A monitoring well was not installed in this 100 Ft. boring; a new boring for well installation was drilled a short distance (less than 5 Ft) from this boring to the appropriate depth for well installation.

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/9-11/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: DW2
BOREHOLE GRND ELEV.: 1640.54 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: EW-1

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. In.	O.V.A. ppm	Feet	Visual Classification
SW1-1	0	2	SS	2, 6, 9	1.1	0	1	(ML) Light to dark brown silty topsoil.
SW1-2	5	7	SS	4, 6, 8, 10	1.9	0	5	Brown silty clay to 6'; changes to gray silty clay w/ orange and black mottling; trace of sand and pebbles.
SW1-3	10	12	SS	4, 4, 9, 11	1.9	0	10	0 -1.2: gray silty clay with orange and black mottling; 1.2 -1.9: lt. brown, silty clay with trace of sand and pebbles.
SW1-4	15	17	SS	7, 9, 12, 17	2.0	60(IB)	15	[illegible] brown silty clay with occasional gravel.
SW1-5	20	22	SS	8, 11, 15, 25	2.0	0	20	(CL) Dark gray silty clay with trace of sand and pebbles.
SW1-6	22	24	SS	3, 9,	1.0	0	22	Same as above with occasional cobble [illegible]

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PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/9-11/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: DW2
BOREHOLE GRND ELEV.: 1640.54 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: SW-1

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect.	Blows per 6" of Drive	Recov. In.	O.V.A. ppm	Feet	Visual Classification
				13			23	
				15				
							24	
							25	
							26	
							27	
SW1-7	28	30	SS	6	2.0	0	28	Same as above.
				10				
				27			29	
				28				
							30	
							3.	
							32	
							33	
							34	
SW1-8	35	37	SS	12	2.0	0	35	Wet sandy silt to 0.2;
				14				0.2 -2.0: dark gray,
				16			36	silty clay.
				25				
							37	
							38	
							39	
SW1-9	40	42	SS	7	2.0	0	40	0 -1.0: fine, silty sand;
				12				1.0 -2.0: dark gray, silty
				18			41	clay; the head of the
				31				spoon had silty sand.
							42	

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/14/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : DeVillez/ Macke/ Volz
DRILLING METHOD: Holow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: DW3
BOREHOLE GRND ELEV.: 1648.57 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-3

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	D.V.A. ppm	Feet	Visual Classification
DW3-1	0	2	SS	2, 1	0.9	0		[ML] 0 -0.1: dk. brn peat;
				3			1	0.1 -0.9: dk. brown clayey
				3				silt w/ some organic debris.
							2	
							3	
							4	
DW3-2	5	7	SS	2	1.1	0	5	Dark gray and brown mottled
				4				silty clay; a silty sand
				4			6	lens at 0.6; trace of
				6				pebbles throughout.
							7	
							8	
							9	
DW3-3	10	12	SS	3	1.9	0	10	Lt. to dk. brown and gray
				6				mottled silty clay with
				7			11	traces of sand and pebbles.
				12				
							12	
							13	
							14	
DW3-4	15	17	SS	5	1.6	0	15	Same as above.
				8				
				11			16	
				14				
							17	
							18	
							19	
DW3-5	20	25	SS	3	1.7	0	20	Same as above.
				6				
				9			21	
				13				
							22	

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PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/14/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : DeVillez/ Macke/ Volz
DRILLING METHOD: Holow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: DW3
BOREHOLE GRND ELEV.: 1648.57 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-3

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
							23	
							24	
DW3-6	25	27	SS	6	2.0	0	25	[CL] Dark gray silty clay with some patchy brown areas and trace of sand and pebbles.
				9				
				14			26	
				17				
							27	
							28	
							29	
DW3-7	30	32	SS	5	1.5	0	30	Dark gray silty clay with trace of sand and pebbles.
				9				
				10			31	
				14				
							32	
							33	
							34	
DW3-8	35	37	SS	6	1.4	0	35	Same as above.
				9				
				14			36	
				18				
							37	
							38	
							39	
DW3-9	40	42	SS	6	1.2	0	40	Same as above.
				9				
				13			41	
				17				
							42	
							43	
							44	
DW3-10	45	47	SS	5	NR	0	45	Same as above.

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PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/14/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : DeVillez/ Macke/ Volz
DRILLING METHOD: Holow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: DW3
BOREHOLE GRND ELEV.: 1648.57 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-3

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
				10				
				12			46	
				14				
							47	

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/17-21/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. Devillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: DW4 (see note on D.1-28)
BOREHOLE GRND ELEV.: 1633.50 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-4, SW-4

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
DW4-1	0	2	SS	6, 6	0.8	0		[ML] Dk brown to blk topsoil;
				6			1	sandy silt with trace of
				7				pebbles.
DW4-2	2	4	SS	2	1.4	0	2	0 -0.8: dk. brn. sandy silt;
				2				0.8 -1.4: dk. brown silty
				5			3	sand and gravel.
				7				
DW4-3	4	6	SS	6	2.0	0	4	0 -0.2: dk. brn. sandy silt;
				8				0.2 -2.0: lt. brown, medium
				11			5	sand with some pebbles.
				14				
DW3-4	6	8	SS	9	1.7	0	6	0 -1.0: same as above;
				14				1.0 -1.7: lt. gray, fine to
				15			7	medium sand with some pebbles
				10				and silt.
DW4-5	8	10	SS	5	0.6	0	8	Lt. brown medium sand with
				5				some silt and pebbles; plug
				7			9	in head of spoon was brown
				8				clay.
DW4-6	10	12	SS	1	0	0	10	No recovery.
				1				
				4			11	
				5				
DW4-7	12	14	SS	2	1.7	0	12	Brown and gray mottled silty
				3				clay with trace of sand,
				5			13	pebbles and lignite.
				8				
DW4-8	14	16	SS	2	1.8	0	14	0 -0.4: brown silty clay with
				4				trace of sand and pebbles.
				6			15	[CL] 0.4 -1.8: Dk. gray silty clay
				8				w/ trace of sand and pebbles.
DW4-9	16	18	SS	3	2.0	0	16	Dark gray silty clay with
				6				trace of sand and gravel.
				8			17	
				10				
DW4-10	18	20	SS	3	0.2	0	18	Same as above.
				7				
				8			19	
				11				
							20	
							21	
							22	

Log Continued on Next Page

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/17-21/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. Devillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: DW4 (see note on D.1-28)
BOREHOLE GRND ELEV.: 1633.50 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-4, SW-4

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
DW4-11	23	25	SS	3	2.0	0	23	Same as above.
				5				
				6			24	
				7				
							25	
							26	
							27	
DW4-12	28	30	SS	4	1.1	0	28	Same as above.
				4				
				6			29	
				8				
							30	
							31	
							32	
DW4-13	33	35	SS	3	1.5	0	33	Same as above with a fine, silty, gray sand lens from 0.9 -1.0; also, tip of spoon and some sand.
				5				
				7			34	
				9				
							35	
							36	
							37	
DW4-14	38	40	SS	12	1.9	0	38	0 -0.4: fine to medium, gray silty sand with some pebbles; 0.4 -1.9: fine, gray, silty sand.
				15				
				16			39	
				21				
							40	
							41	
							42	
DW4-15	43	45	SS	7	1.5	0	43	0 -0.3: medium, gray, silty sand with some pebbles. 0.3 -1.5: dk. gray, silty clay with some pebbles. 2 very small sand lenses
				10				
				11			44	
				17				
							45	

Log Continued on Next Page

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/17-21/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. Devillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: DW4 (see note on D.1-28)
BOREHOLE GRND ELEV.: 1633.50 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-4, SW-4

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
								(<.05°) at 1 and 1.4.
							46	
							47	
DW4-16	48	50	SS	7	1.7	0	48	Dark gray silty clay with trace of sand and pebbles and small sand lenses at 1 and 1.4.
				11				
				13			49	
				18				
							50	
							51	
							52	
DW4-17	53	55	SS	14	2.0	0	53	Fine to med, gray sand, fairly well sorted & rounded, and some silt; lens of dark gray, sandy silt with some pebbles at 1.7 -1.8.
				29				
				35			54	
				50				
							55	
							56	
							57	
DW4-18	58	60	SS	20	1.4	0	58	Same as above.
				30				
				40			59	
				40				
							60	
							61	
							62	
DW4-19	63	65	SS	20	1.5	0	63	Lens of pebbles from 0 -0.2; 0.2 -1.5: same sand as above.
				22				
				37			64	
				43				
							65	
							66	
							67	

Log Continued on Next Page

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/17-21/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. Devillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: DW4(see note on D.1-28)
BOREHOLE GRND ELEV.: 1633.50 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-4, SW-4

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
DW4-20	68	70	SS	25	1.0	0	68	0 -0.8: same sand as above;
				33				0.8 -1.0: dark gray, silty
				21			69	clay with trace of sand
				33				and pebbles.
							70	
							71	
							72	
DW4-21	73	75	SS	25	1.7	0	73	0 -1.1: fn.-med. silty sand;
				28				1.1 -1.3: med-crs sand;
				24			74	1.3 -1.7: alternating silty
				26				clay and fine sand with
							75	trace of pebbles.
							76	
							77	
DW4-22	78	80	SS	25	1.7	0	78	Fine silty sand.
				35				
				42			79	
				55				
							80	
							81	
							82	
DW4-23	83	85	SS	22	1.6	0	83	Very fine silty sand.
				31				
				60			84	
				100/4"				
							85	
							86	
							87	

Log Continued on Next Page

PROJECT NAME: USAF-HAFB
DATE DRILLED: 10/17-21/86
DRILLING LOCATION : Landfill
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: DW4*
BOREHOLE GRND ELEV.: 1633.50 ft. msl
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: DW-4, SW-4

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
							88	[CL]
DW4-24	88	90	SS	24	1.3	0		0 -0.4: fine sand;
				18				0.4 -1.3: dark gray, silty
				27			89	clay with trace of pebbles.
				42				
							90	
							91	
							92	
DW4-25	93	95	SS	50	0.6	0	93	Fine sand with a lens of
				100/4"				coarse sand.
							94	
							95	
							96	
							97	
DW4-26	98	100	SS	17	NM	0	98	Lenses of fine, gray sand and
				27				dark gray silty clay.
				35			99	
				50				
							100	

* A monitoring well was not installed in this 100 Ft boring; a new boring for well installation was drilled a short distance (less than 5 Ft) from this boring to the appropriate depth for well installation.

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/22/86
DRILLING LOCATION : F.T.A.
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: TB1
BOREHOLE GRND ELEV.: Not Surveyed
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: None

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
TB1-1	0	2	SS	3, 5	0	20		[ML] No sample recovery; gravel
				3			1	and silty/sandy fill;
				3				soil is visibly contaminated
							2	and has a strong odor.
							3	
							4	
TB1-2	5	7	SS	1	1.3	10-20	5	Greenish-gray clayey silt.
				3				
				4			6	
				5			7	
							8	
							9	
TB1-3	10	12	SS	2	1.5	300	10	Lt. brown clayey silt; some
				4				black staining & strong odor.
				5			11	
				6				
							12	
							13	
							14	
TB1-4	15	17	SS	2	1.8	600	15	Brownish-green clayey silt;
				3				strong odor.
				8			16	
				7				
							17	
							18	
							19	
TB1-5	20	22	SS	4	1.8	3	20	Lt. brown clayey silt;
				9				slight odor.
				9			21	
				11				
							22	

Log Continued on Next Page

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/22/86
DRILLING LOCATION : F.T.A.
ON SITE GEOLOGIST : V. DeVillez/ J. Volz
DRILLING METHOD: Hollow Flight Auger

PROJECT NUMBER: 01071-00
BORING NUMBER: TB1
BOREHOLE GRND ELEV.: Not Surveyed
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: None

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
							23	
							24	
TB1-6	25	27	SS	6	1.7	0	25	[CL] Dark gray silty clay with trace of pebbles; sand lens at 0.3.
				9				
				8			26	
				11				
							27	
TB1-7	28	30	SS	6	1.6	1	28	Same as above, no sand.
				7				
				9			29	
				11				
							30	

PROJECT NAME: USAF-MAFB
DATE DRILLED: 10/24/86
DRILLING LOCATION : E.O.D.
ON SITE GEOLOGIST : V. DeVillez, J. Volz
DRILLING METHOD: Hollow Flight Auger

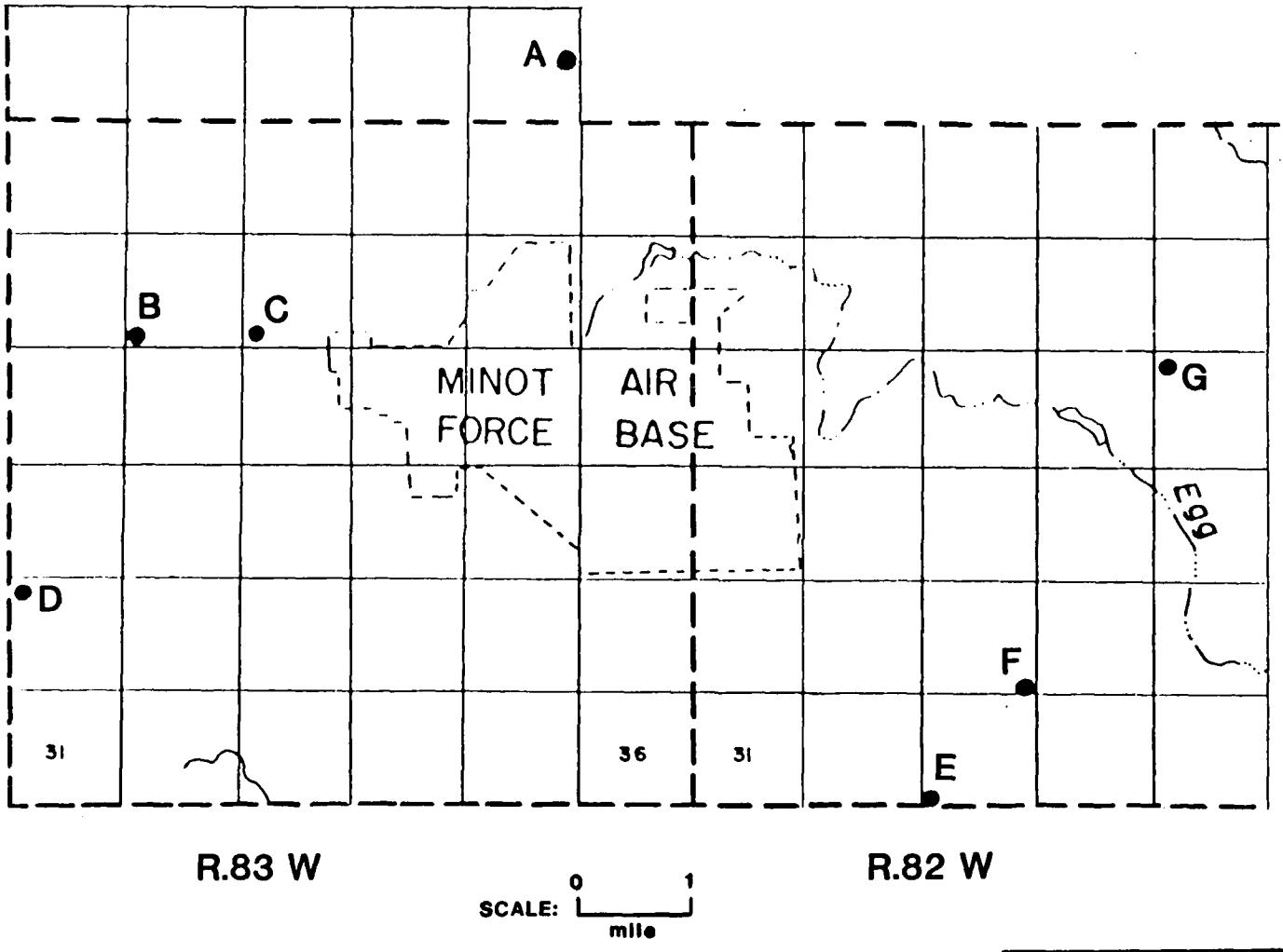
PROJECT NUMBER: 01071-00
BORING NUMBER: TB2
BOREHOLE GRND ELEV.: Not Surveyed
DRILLING COMPANY: Twin City Testing
WELL(S) INSTALLED: None

Sample Number	Sample Depth Begin Ft.	Sample Depth End Ft.	Method of Sample Collect	Blows per 6" of Drive	Recov. Ft.	O.V.A. ppm	Feet	Visual Classification
TB2-1	0	2	SS	2, 2, 2	0.5	0	1	(ML) Dark brown silty topsoil.
				2			2	
							3	
							4	
TB2-2	5	7	SS	3	2.0	0	5	Lt. brown silty clay with white and orange mottling.
				4			6	
				7			7	
				9			8	
							9	
TB2-3	10	12	SS	4	2.0	0	10	Same as above.
				5			11	
				9			12	
				11			13	
							14	
TB2-4	15	17	SS	[illegible]	[illegible]	0	15	Same as above.
				6			16	
				8			17	
				12			18	
TB2-5	18	20	SS	4	2.0	0	19	Same as above.
				7			20	
				10				
				15				

APPENDIX D.2

BORING LOGS FOR USGS TEST BORINGS COMPLETED IN THE VICINITY OF MAFB

(CL5060B/0528N)



SOURCE: Pettyjohn & Hutchinson, 1971

LOCATION MAP FOR U.S.G.S.
TEST BORINGS A THROUGH G

FRED C. HART ASSOCIATES, INC.

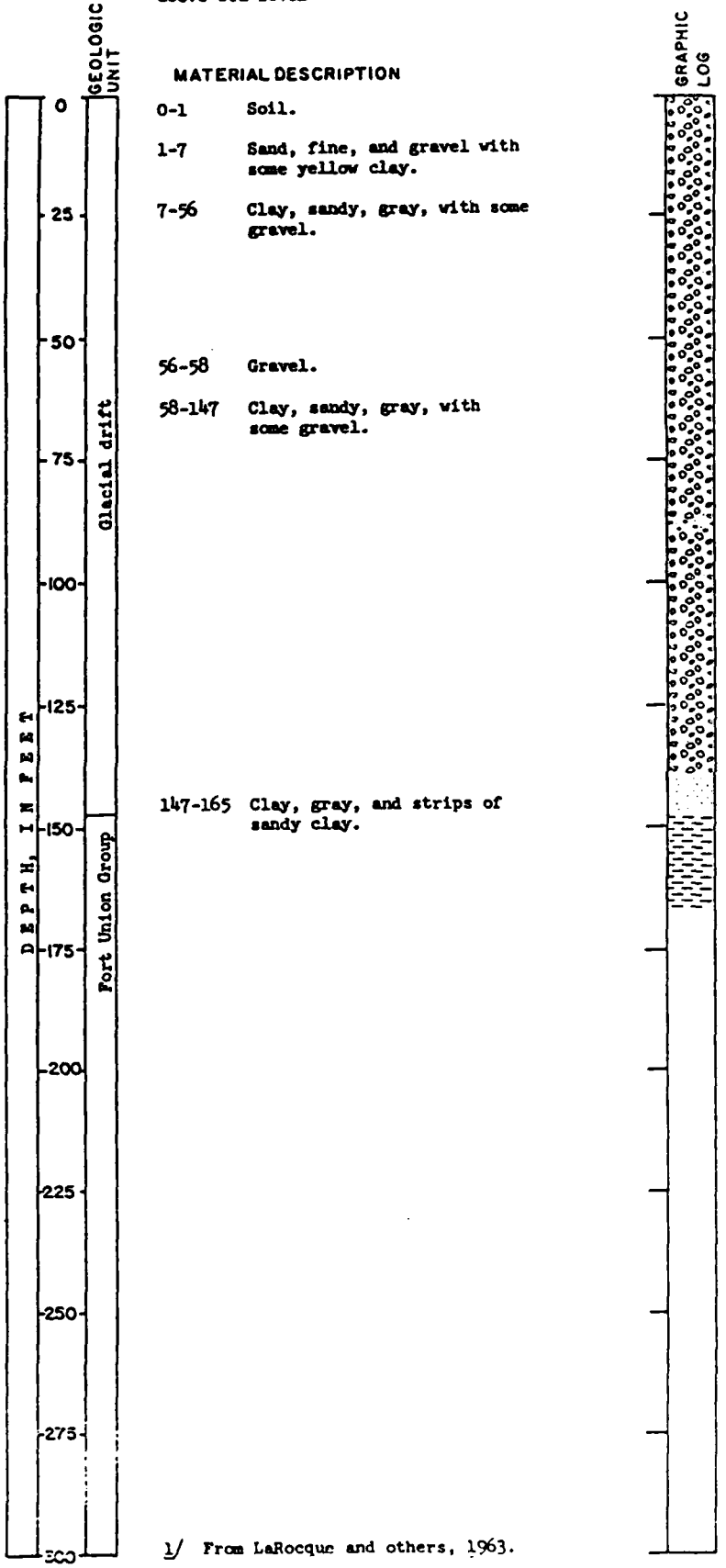
LOCATION: Renville County 158-83-35ad

TEST HOLE U.S. Geol. Survey 1/

DATE DRILLED: 1947

ELEVATION: 1,610 feet above sea level

DEPTH: 165 feet



MATERIAL DESCRIPTION

0-1	Soil.
1-7	Sand, fine, and gravel with some yellow clay.
7-56	Clay, sandy, gray, with some gravel.
56-58	Gravel.
58-147	Clay, sandy, gray, with some gravel.
147-165	Clay, gray, and strips of sandy clay.

1/ From LaRocque and others, 1963.

1971 USGS TEST BORING A

SOURCE:
Pettyjohn and Hutchinson, 1971

FRED C. HART ASSOCIATES, INC.

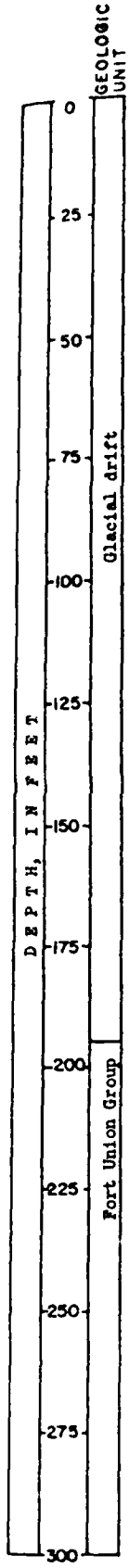
TEST HOLE 2366

LOCATION: Ward County 157-83-8ccc

DATE DRILLED: July 15, 1965

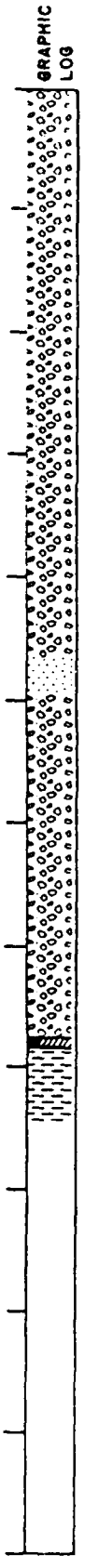
ELEVATION: 1,710 feet above sea level

DEPTH: 210 feet



MATERIAL DESCRIPTION

0-27	Till, silty and sandy, yellow-brown.
27-117	Till, silty and sandy, olive-gray; few thin layers of sand and gravel.
117-124	Sand, fine to medium.
124-194	Till, silty and sandy, olive-gray; few thin layers of sand and gravel.
194-196	Lignite, black.
196-210	Clay, sandy, olive-gray.



1971 USGS TEST BORING B

SOURCE:
Pettyjohn and Hutchinson, 1971

FRED C. HART ASSOCIATES, INC.

TEST HOLE

LOCATION: Ward County 157-83-9ccc — U.S. Geol. Survey[1/]

DATE DRILLED: July 31, 1947

ELEVATION: 1,687 feet above sea level

DEPTH: 210 feet

DEPTH, IN FEET	GEOLOGIC UNIT	MATERIAL DESCRIPTION	
0	Glacial drift	0-1	Soil.
		1-4	Clay, yellow, with some gravel and fine sand.
25		4-10	Clay, yellow, with some gravel.
		10-13	Clay, sandy, yellow, with strips of fine sand.
		13-17	Sand, fine.
50		17-28	Clay, sandy, gray.
		28-34	Clay, sandy, gray, with strips of fine sand.
75		34-40	Sand, fine.
		40-54	Clay, sandy, gray, with thin strips of gravel and fine sand.
		54-58	Clay, sandy, gray, with some gravel.
100		58-60	Sand, fine and gravel.
		60-63	Clay, sandy, gray, with thin strips of gravel.
125		63-81	Clay, sandy, gray, with some gravel and some thin strips of gravel.
		81-82	Gravel and fine sand.
150		82-84	Clay, sandy, gray, with thin strips of gravel.
		84-85	Gravel and fine sand.
175		85-91	Clay, sandy, gray, with thin strips of gravel.
		91-94	Sand, fine, and gravel with some lignite fragments.
200	Fort Union Group	94-121	Clay, sandy, gray, with thin strips of gravel and lignite fragments.
		121-162	Clay, sandy, gray, with gravel and fine sand and thin strips of gravel.
225		162-163	Boulders.
		163-178	Clay, sandy, gray, with thin strips of gravel and fine sand.
250		178-190	Clay, sandy, gray, with some gravel.
		190-196	Clay, sandy, gray, with strips of fine sand and gravel.
275		196-210	Sand, compact, gray.
300			

GRAPHIC LOG

1/ From LaRocque and others, 1963.

1971 USGS TEST BORING C

SOURCE:
Pettyjohn and Hutchinson, 1971

FRED C. HART ASSOCIATES, INC.

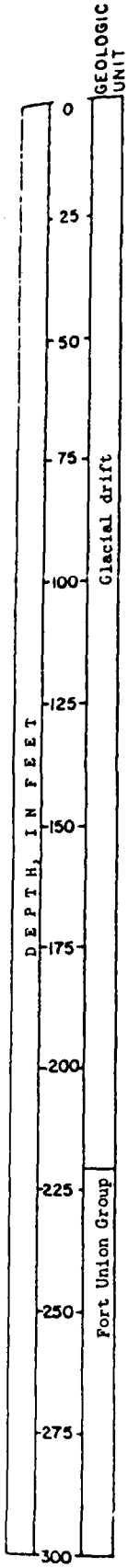
LOCATION: Ward County 157-83-30bbb

TEST HOLE
U.S. Geol. Survey[1/]

DATE DRILLED: July 31, 1947

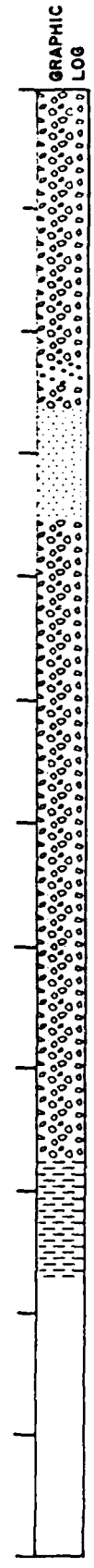
ELEVATION: 1,760 feet above sea level

DEPTH: 245 feet



MATERIAL DESCRIPTION

0-3	Soil.
3-12	Clay, yellow.
12-46	Clay, gray, with some gravel.
46-56	Clay, sandy, gray, with some strips of fine sand and gravel.
56-60	Sand and gravel.
60-64	Clay, sandy, gray.
64-87	Sand, fine, and gravel.
87-220	Clay, sandy, gray, with some gravel and lignite fragments.
220-245	Clay, brown and gray, with some gray sandy clay.



1/ From LaRocque and others, 1963.

1971 USGS TEST BORING D

SOURCE:
Pettyjohn and Hutchinson, 1971

FRED C. HART ASSOCIATES, INC.

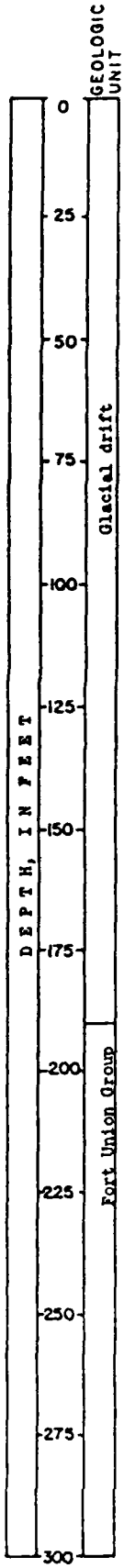
LOCATION: Ward County 157-82-33ccc

TEST HOLE 1971

DATE DRILLED: September 22, 1971

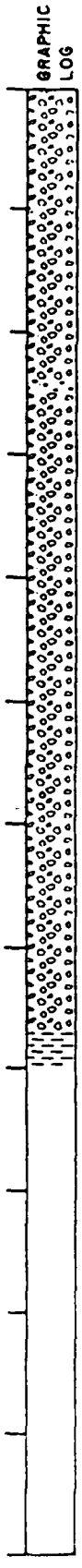
ELEVATION: 1,645 feet above sea level

DEPTH: 199.5 feet



MATERIAL DESCRIPTION

0-28	Till, yellow-gray, and fine to coarse gravel.
28-59	Till, gray, and fine to medium gravel.
59-61	Gravel, fine.
61-190	Till, gray, and fine to medium gravel.
190-199.5	Clay, sandy, gray.



1971 USGS TEST BORING E

SOURCE:
Pettyjohn and Hutchinson, 1971

FRED C. HART ASSOCIATES, INC.

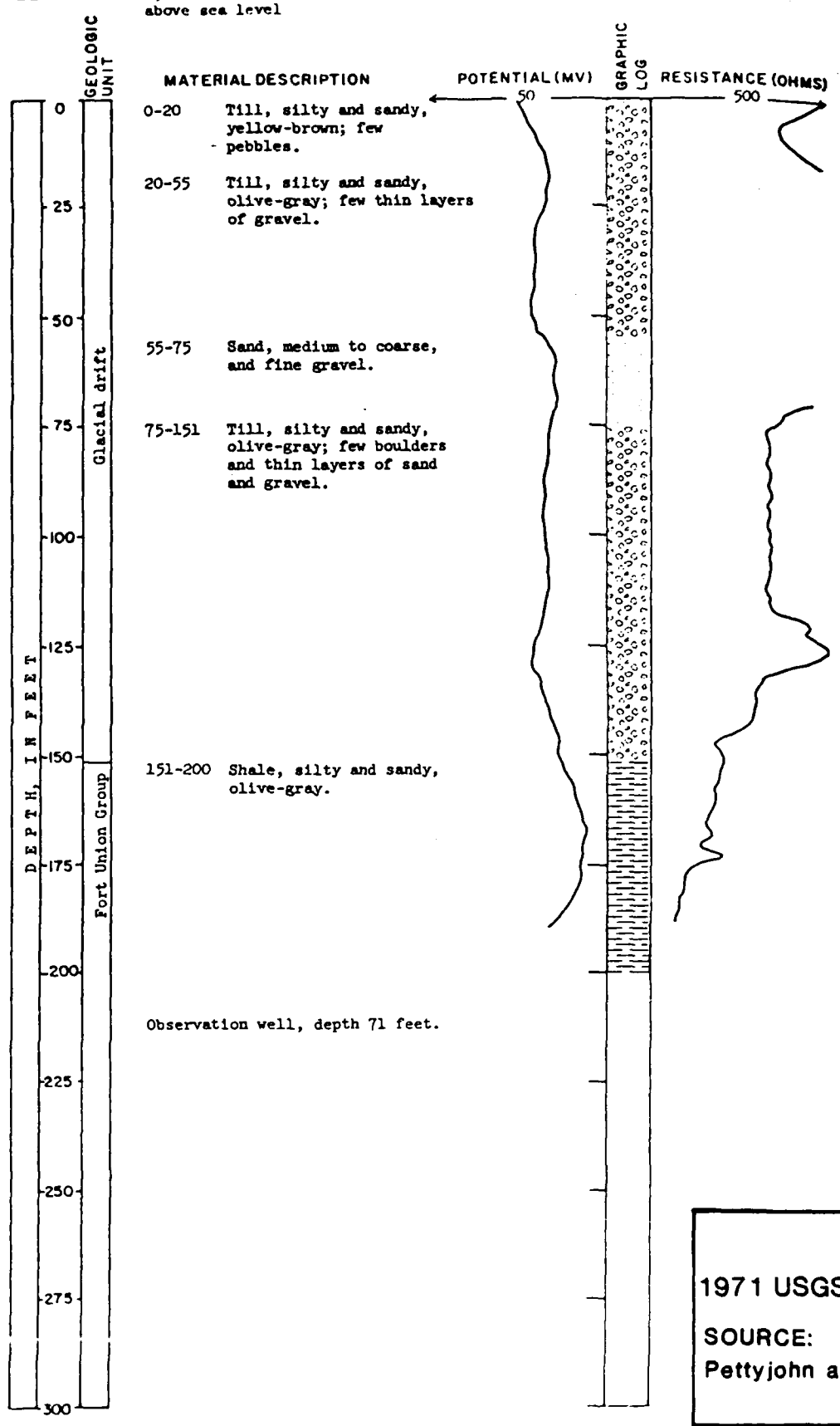
TEST HOLE 3241

LOCATION: Ward County 157-82-14bbb

DATE DRILLED: July 29, 1965

ELEVATION: 1,602 feet above sea level

DEPTH: 200 feet



1971 USGS TEST BORING F

SOURCE:
Pettyjohn and Hutchinson, 1971

FRED C. HART ASSOCIATES, INC.

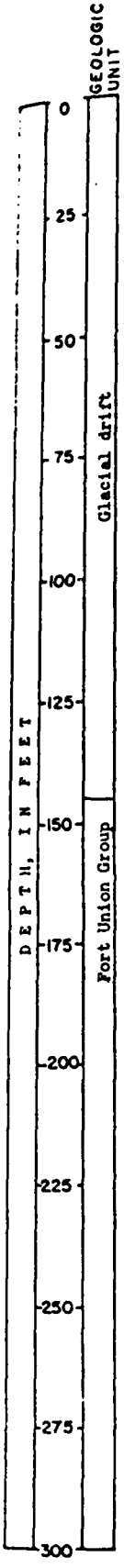
LOCATION: Ward County 157-82-28ddd

TEST HOLE U.S. Geol. Survey 1/

DATE DRILLED: August 1, 1947

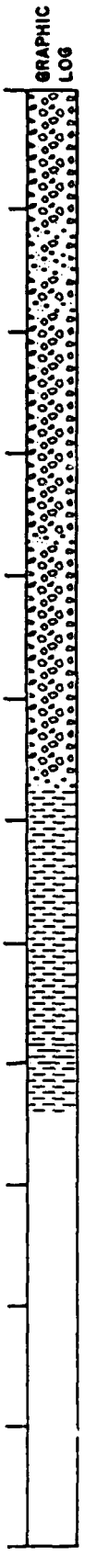
ELEVATION: 1,619 feet above sea level

DEPTH: 210 feet



MATERIAL DESCRIPTION

0-2	Soil.
2-17	Clay, yellow, with some gravel.
17-23	Clay, sandy, brown, with some gravel.
23-28	Clay, sandy, gray, with some gravel.
28-31	Gravel.
31-35	Clay, sandy, gray, with strips of gravel.
35-40	Gravel.
40-46	Clay, sandy, gray, with strips of gravel.
46-47	Gravel.
47-83	Clay, sandy, gray, with some gravel.
83-91	Clay, sandy, gray, with thin strips of gravel and lignite fragments.
91-94	Gravel, with strips of gray sandy clay and lignite fragments.
94-100	Clay, sandy, gray, gravel, with thin strips of lignite fragments.
100-119	Clay, sandy, gray, with gravel and fine sand and thin strips of lignite fragments.
119-130	Clay, sandy, gray, with thin strips of fine sand, gravel, and lignite fragments.
130-132	Clay, sandy, gray, with some gravel and boulders.
132-142	Clay, sandy, gray.
142-144	Gravel, with strips of gray sandy clay.
144-197	Clay, sandy, gray.
197-201	Shale.
201-210	Clay, sandy, gray.



1/ From LaRocque and others, 1963.

1971 USGS TEST BORING G

SOURCE:
Pettyjohn and Hutchinson, 1971

FRED C. HART ASSOCIATES, INC.

APPENDIX E

FIELD RAW DATA

JOB INFORMATION:

Project #: 01071-00-86008-00 Location: MAFB, Minot, ND

Client: USAF Dates of Report: 10·6 - 10·10·86

Field Team Leader: V. DeVillez

DAILY FIELD ACTIVITIES

1. Date: 10·6·86

HART Personnel On-site: R. Goldman, V. DeVillez, J. VOLZ

Subcontractors On-site: Twin City TESTING: J. Zellinger, Hugh Jacobson, Max Tschosick

Work Accomplished: Located all boring/well locations and sediment sampling locations. Met w/ USAF personnell: Capt DeMay (Biolnv Eng), Scott Smith & John Boucher (Civil Eng.)

Problems Encountered:

---

2. Date: 10·7·86

HART Personnel On-site: RDG, VJD, JV

Subcontractors On-site: Twin City TESTING

Work Accomplished: Met w/ Capt. Johnson (Brooks AFB). Relocated DW1/SW2 to N. side of drainage ditch & SW5 across the road from the SLF. Drilled test boring for DW1/SW2 to 72FT.

Problems Encountered:

3. Date: 10-8-86
HART Personnel On-site: VJD, ROG, JV

Subcontractors On-site: Twin City Testing: M.T., H.J.

Work Accomplished: Completed TB-OW1/SW2 to 100 FT and grouted hole. Drilled + installed SW2 at 20'. (Dry)

Problems Encountered: Swivel which holds grout rods was difficult to connect to rods (Will repair); No H2O in SW2

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4. Date: 10-9-86
HART Personnel On-site: VJD, JV

Subcontractors On-site: Twin City: H.J., M.T.

Work Accomplished: Completed SW3 (25'). Drilled boring for SW1 to 25', dry, so boring left open until later time.

Problems Encountered: No H2O in SW1.

---

5. Date: 10-10-86
HART Personnel On-site: VJD, JV

Subcontractors On-site: Twin City: H.J., M.T.

Work Accomplished: Installed + drilled DW1. Talked to Capts. Johnson + De May on conference call to re-evaluate field plan due to lack of H2O in shallow borings.

Problems Encountered:

JOB INFORMATION:

Project #: 01071-00-86008-00 Location: MAFB, Minot, ND

Client: USAF Dates of Report: 10-11-10-13-86

Field Team Leader: V. DeVillez

DAILY FIELD ACTIVITIES

1. Date: 10-11-86

HART Personnel On-site: VJD, JV

Subcontractors On-site: TWINCity: H.J. M.T.

Work Accomplished: Drilled SW-1 from 25' to 43.5' - installed well @ 43', moveing to OW3 location.

Problems Encountered: Rig stuck at OW3 location adjacent to lagoon.

---

2. Date: 10-13-86

HART Personnel On-site: VJD, JV

Subcontractors On-site: TWIN City: H.J., M.T.

Work Accomplished: Bailed SW3 to check recharge rate - bailed dry in 5-10 bails. Bailed OW4 + SW4. Organized sampling procedure and sampling equipment.

Problems Encountered: Could not find a dozer operator to pull rig out of trench - today is Columbus Day + all Gov't employees are not working today.

JOB INFORMATION:

Project #: 0107-00-86008-00 Location: MAFB, Minot, ND
Client: USAF Dates of Report: 10-14-86 to 10-17-86
Field Team Leader: V. DeVillez; Bruce Macke

DAILY FIELD ACTIVITIES

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2. Date: 10-14-86
HAZ Personnel On-site: Jim Volz, Vanessa DeVillez until 2:00pm, and Bruce Macke from 12:00 PM.
Subcontractors On-site: Twin City Testing; Hugh Iverson and MAX Tschoslck
Work Accomplished: Installed MW3

Problems Encountered: Very difficult well construction.

3. Date: 10-15-86
HART Personnel On-site: Jim Volz, Bruce Macke
Subcontractors On-site: Twin Cities Testing; Hugh Jacobson and MAX Tschdsick
Work Accomplished: Installed DW2
Problems Encountered:

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4. Date: 10-16-86
HART Personnel On-site: Jim Volz, Bruce Macke
Subcontractors On-site: Twin Cities Testing; Hugh Jacobson and MAX Tschdsick
Work Accomplished: Installed SW6
Problems Encountered:

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5. Date: 10-17-86
HART Personnel On-site: Jim Volz, Bruce Macke until 11:00AM
Subcontractors On-site: Twin Cities Testing; Hugh Jacobson and MAX Tschdsick
Work Accomplished: Installed SW6; 50' of TB5W4 boring completed.
Problems Encountered:

JOB INFORMATION:

Project #: 01071-00-8600800 Location: MAFB, MINOT, ND

Client: USAF Dates of Report: 10-20-86 - 10-24-86

Field Team Leader: V. DeVilbiz

DAILY FIELD ACTIVITIES

1. Date: 10-20-86

HART Personnel On-site: VJD, JV

Subcontractors On-site: TWIN City: H.J., M.T.

Work Accomplished: Drilled TB-SW4/DW4 from 50' to 100'.

Problems Encountered: TB-SW4/DW4 started to collapse and caused the switch from HSA to mud rotary drilling. Started DW4 well installation.

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2. Date: 10-21-86

HART Personnel On-site: VJD, JV

Subcontractors On-site: TWIN City: H.J., M.T.

Work Accomplished: Completed SW4 well installation; Drilled & installed DW4.

Problems Encountered: SW4: augers stuck in hole, sand bridged augers.

3. Date: 10·22·86
HART Personnel On-site: VJD, JV

Subcontractors On-site: TWIN City: H.J., M.T.

Work Accomplished: Completed TB-1 in the FTA; Drilled boring for SW7 to 27' - no H_2O, left open overnight. Run soil samples from TB-1 on the OVA in injection mode.

Problems Encountered: No H_2O in SW-7 @ 27FT.

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4. Date: 10·23·86
HART Personnel On-site: VJD, JV

Subcontractors On-site: TWIN City: H.J., M.T.

Work Accomplished: Drilled boring for SW8 to 30' - no H_2O. Drilled and installed SW 9 @ 23'. Collected sediment samples from ditch draining FTA.

Problems Encountered: Flame would not light on OVA due to a loose connection.

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5. Date: 10·24·86
HART Personnel On-site: VJD, JV

Subcontractors On-site: TWIN City: H.J., M.T.

Work Accomplished: Installed SW8; Grouted SW7, Drilled TB2.

Problems Encountered:

JOB INFORMATION:

Project #: 01071-00-86008-00 Location: MAFB-MINOT, ND

Client: USAF Dates of Report: 10-25-10.29.86

Field Team Leader: V. DeWilder

DAILY FIELD ACTIVITIES

1. Date: 10.25.86

HART Personnel On-site: VJD, JV

Subcontractors On-site: Twin City: H.J., M.T.

Work Accomplished: took Shelby tubes in SW 8 + SW 9. Installed guard posts at wells.

Problems Encountered:

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2. Date: 10.27.86

HART Personnel On-site: VJD, JV

Subcontractors On-site: TWIN City: H.J., M.T.; READY-Mix company.

Work Accomplished: Concrete pads installed at all wells. Developed wells.

Problems Encountered:

3. Date: 10·28·86
HART Personnel On-site: VJD, JV

Subcontractors On-site:

Work Accomplished: Well development; Evacuated wells SW3, SW4, SW5, SW9, + DW2.

Problems Encountered:

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4. Date: 10·29·86
HART Personnel On-site: VJD, JV

Subcontractors On-site:

Work Accomplished: Evacuated wells: SW1, SW6, SW8, DW1, and DW3, DW4, MW1, MW2, MW3, MW4. Sampled wells SW3, SW4, SW5, SW9, + DW2.

Problems Encountered:

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5. Date: 10·30·86
HART Personnel On-site: VJD, JV

Subcontractors On-site:

Work Accomplished: Sampled wells SW1, DW1, DW3, SW6, DW4, SW8, MW1, MW2, MW3, MW4, COE.

Problems Encountered:

JOB INFORMATION:

Project #: 01071-00-86008-00 Location: MAFB-MINOT, ND
Client: USAF Dates of Report: 10-31-11-2-86
Field Team Leader: V. DeVillez

DAILY FIELD ACTIVITIES

1. Date: 10-31-86
HART Personnel On-site: VJD, JV

Subcontractors On-site:

Work Accomplished: Packed Equipment; Located surface water sampling points in the SLF. Permanently marked sediment sampling points in FTA drainage ditch.
Problems Encountered:

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2. Date: 11-1-86
HART Personnel On-site: VJD

Subcontractors On-site:

Work Accomplished: Painted well guard posts, painted numbers on wells. Shipped equipment.
Problems Encountered:

3. Date: 11-2-86

HART Personnel On-site: VJD

Subcontractors On-site:

Work Accomplisned: Sampled surface waterpoints in SLF

Problems Encountered:

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4. Date:

HART Personnel On-site:

Subcontractors On-site:

Work Accomplished:

Problems Encountered:

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5. Date:

HART Personnel On-site:

Subcontractors On-site:

Work Accomplisned:

Proble Encountered:

FTA & EOD OVA RESULTS

Well / Boring	(ppm) OVA HEADSPACE	SAMPLE NO.	Depth	DATE of Analysis	Sample DATE
FTA TB-1	≈100ppm	3	10-12'	10-22-86	"
"	>1000ppm	2	5-7'	10-22-86	"
"	7000ppm	4	15-17'	10-22-86	"
"	≈200ppm	5	20-22'	10-22-86	"
"	≈100ppm	6	25-27'	10-22-86	"
"	≈100ppm	7	28-30'	10-22-86	"
NOTE:	ABOVE READINGS		INVALID - INJECTION		
	BUTTON ON OVA		was not depressed.		
	SAMPLES WERE		RERUN IMMEDIATELY.		
✓	≈800ppm	2			HARTOO1
✓	≈700ppm	3			HARTOO2
* ✓	≈840ppm	4			" 003
✓	≈100ppm	5			" 004
	≈80ppm	6			
	≈60ppm	7			
FTA					
SD-1 (sediment sampled)	100	S-1	0-0.5'	10-24-86	10-23
SD-1	✓700	S-2	0.5-1.0'	"	HARTOO5
SD-2	✓600	S-1	0-0.5'	"	HARTOO6
SD-2	190	S-2	0.5-1.0	"	"

Sample Location	OVA (ppm)	Sample No.	Depth	Analysis DATE	Sample DATE
SD-3	✓100	S-1	0-0.5'	HARTOO7 10.24.86	10.23
SD-3	60	S-2	0.5-1.0'	"	"
SD-4 ✓	—	S-1	0.5-1.0'	HARTOO8 NO SAMPLE taken for analysis Duplicate of SD-2, S-2, 0.5-1.0)	"
EOD					
TB-2	6	SS-1	0-2	10.24	10.24
TB-2	✓14	SS-2	5-7	HARTOO9 10.24	10.24
TB-2	6.2	SS-3	10-12	"	"
TB-2	10	SS-4	15-17	"	"
TB-2	✓20	SS-5	18-20	HARTO10 "	"
		SS-6		HARTO11	

✓ = SAMPLES SENT TO PTL

* = " " " OEHC & PTL

WELL DEVELOPMENT DETAILS

Well No.	Date	Depth to water (TOC)	Time	Comments	
1	10.25	3.28	3:00	TD = 32' (TOC) (4) bails = 10, 10, 10, 10, 10, 10, 10; silt in bottom of well, bailed dry	
2	"	6.78	3.40	T.D = 20.6 (TOC) silt in bottom, bailed dry	10, 10, 10, 10, 10, 5
3	10.28	6.	9:30	TD = Not [illegible]	[illegible]
4	10.29			"	
COE					
SW-1	10.27	8.42	12.30	TD = 45.15	TD = 45.15 10, 10, 10, 10, 10, 60
SW-2	"	18.15'	2:50	TD 22'	5 bails (bailed dry)
SW-3	10.28	11.96	8:00	TD = 27.01	31 bails (5 gals)
SW-4	"	8.33		TD = 17.87 Dryness	75 bails (13 gal)
SW-5	"	8.17		TD = 19.77 Dryness	20 bails (3.5 G)
SW-6	10.27	6.13	5:15	TD = 22.01 bailed dry	20 bails
SW-8	10.28	7.80		TD = 21.53 Dryness	20 (4 G)

(continued)

Well No.	Date	Depth to water (TOC)	Time	Comments
SW-9	10.28	7.79	5:00	TD = 24.57 55 bails (9 G)
DW-1	10.27	6.11'	2:50-3:55	50 bails (bailed dry) TD = 51.23
OW-2	10.28	6.86	9:00	TD = 17.6 120 bails (20 gal.)
DW-3	10.27	21.28	4:40	TD = 45.82 (bailed dry) ~8 bails
OW-4	10.28	7.34	5:00	TD = 49.22 50 bails (8 gals) (STOP)
COE				[illegible] by [illegible]

well development Details

well no.	pH	µs/cm Spec. Cond	T (C)	Date	# bails
SW-1	7.5	1.71	10	10·27	
"	6.9	1.71	10	"	20
					(20)
SW-2	7.1	2.14	10	"	3
DW-1	7.3	1.83	10	"	35
DW3	7.8	5.73	8°	"	10
	7.4	2.73	8°		25
SW 6	6.4(?)	6.45	8	"	5
	6.9	6.58	8	"	20
DW-2	6.85	1.65			
	7.35	1.78	8	10·28	6
	6.95	1.89	8	"	20
	6.70	1.82	8	"	45
SW-3	6.5	5.76	8	"	5
	6.6	5.84	8	"	10
DW-4	7.35	1.63	8	"	10
	8.60	2.36	8	"	25
	7.30	3.71	8	"	40
SW-4	8.5	5.42	10	"	5
	8.25	5.50	9	"	12
SW-5	7.00	7.99	8	"	5
	7.00	7.02	8	"	12

well	pH (pH)	spec conductivity	T° C	Date	# bails
SW-8	6.9	2.84	8	1028	5
	7.1	2.77	8	"	20
				~~10·29~~	
SW-9	~~7.1(?)~~	17.87	8	"	5
	(7.15)	17.72	8	"	30

pH increased 10·29; battery too weak 10·28

MW3	10.9	2.10	7	10·29	46 (16 bails)

Well Sampling Data 10-27

	DTW	Time	pH	Sp. Cond	Temp
SW-9	6.04	12:00p	13.8	17.62	8°
SW-5	8.46	1:05	9.95	7.48	8
SW-4	8.48	2:00p	12.6	5.33	8
	Field	Blank taken before SW-4			
SW-3	6.03	3:00p	13.35	5.84	8°
SW-2	7.00	3:30p	12.75	2.86	8°
	10-30-86				
SW-1	10.16	10:30A	6.65	1.71	8
DW-1	14.61	11.00	6.90	2.12	8°
SW-6	6.76	11:30	7.15	4.57	8°
DW3	4167	11:45	11.35	3.07	8
DW4	13.85	11:00p	6.65	4.67	8
SW8	8.1	1:25p	8.65	2.64	8
MW1	5.43	2:00p	11.4	1.76	8

			pH	S.C.	T(°)
MW2	18.84	2:25	11.0	3.47	8°
MW3	13.25	2:55p	10.40	2.00	8°
MW4		4:30	9.60	2.29	8°
	14.49	5:00p			
CoE			7.60	3.23	8°

			pH	S.C.	T(°)
SWA	9:30A	11-2	9.25	6.01	8°C
SWB	10:00A		7.45	3.04	"
SWC	10:15	8.25		5.08	"
SWD	10:25	8.05		3.63	"
SWE	9:45A	(Dupl. of SWA)			

APPENDIX F

FIELD ANALYTICAL PROCEDURES, SAMPLE IDENTIFICATION CROSS REFERENCE AND DATES OF SAMPLE ANALYSES

(CL5060B/0528N)

APPENDIX F.1

FIELD ANALYTICAL PROCEDURES

(CL5060B/0528N)

FIELD ANALYTICAL PROCEDURES

Chemical Data

- Procedures for Field Measurement of pH. The pH measurement of water samples was obtained from a portion of the sample retained in a clean glass jar. The measurement was made immediately following sample collection and the pH meter was allowed to stabilize for several minutes prior to recording the measurement. The pH meter was calibrated daily to a range of laboratory-prepared pH buffer solutions. The users manual for the pH meter (Corning Model 3 pH Meter) was available to field personnel.

- Procedures for Field Measurement of Electrical Conductivity. The electrical conductivity measurement of water samples was obtained from a portion of the sample retained in a clean glass jar. The measurement was made immediately following sample collection and the conductivity meter was allowed to stabilize for several minutes prior to recording the measurement. The conductivity meter was calibrated daily to a laboratory-prepared standard of known conductivity. The users manual for the electrical conductivity meter (Markson Model 800-525-5114 Conductivity Meter) was available to field personnel.

- Procedures for Field Measurement of Temperature. The temperature of water samples was measured with a standard thermometer for a portion of the sample retained in a clean glass jar. The temperature measurement was made immediately following sample collection and the thermometer was allowed to stabilize for several minutes prior to recording the measurement.

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- Procedures for Field Measurement of Volatile Organics (Headspace Analysis). Approximately 20 milliliters (ml) of soil from each sampling location was placed in 40-ml VOA vials. The vials were stored on ice in the field until headspace analysis could be performed. Prior to withdrawal of headspace vapors, each vial was placed in a 40°C hot water bath for twenty minutes. An aliquot of air from the headspace within the vial was then withdrawn by syringe for direct injection into the OVA.

Hydraulic Data

- Procedures for Measurements. An M-scope (Slope Indicator Co., Model 51453) was used to measure the water levels in each well under static conditions. The north side of the top of the PVC well casing (2" diameter) was marked and used as a reference point for measurements. Water level measurements were obtained to an accuracy of 0.01 ft.

Soil Boring Data

- Soil Sampling. Split-spoon samples were collected at each test boring location. Split-spoons were 2-foot long, 2-inch outside diameter and were constructed of stainless steel. Sample depth was monitored by the subcontractor (driller) under the supervision of the on-site HART hydrogeologist. As discussed in Chapter III of the technical report, split-spoons were decontaminated before and after use at each sampling depth. Samples were described in the field by a HART hydrogeologist and a portion of the sample was retained as a visual record.

- Blow Counts. Split-spoon samples were driven by a 130-lb hammer falling 30 inches. Soil density was determined by recording the number of blows necessary for the split-spoon to penetrate six inches of soil.

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SAMPLE NUMBERING SYSTEM

A sample numbering system was used to identify each sample taken during the on-site field investigation. The numbering system provides a tracking procedure to allow retrieval of information about a particular site and assure that each sample is uniquely numbered. A listing of sample numbers was maintained by the HART field team leader. Each sample number consisted of four parts, as described below.

Project Identification

The designation MAFB was used to identify the Minot Air Force Base.

Site Identification

Each sampling site was identified by an identifier code, with one of the following prefixes:

- COE - Corps of Engineers well;
- DW - Deep well;
- MW - Monitoring well (not installed by HART);
- SD - Sediment sample;
- SW - Shallow well (number after indicates a shallow well sample number);
- SW - Surface water (letter after indicates a surface water sample number); and
- TB - Test boring.

Numerical or alphabetical suffixes unique to each prefix follow the identifier codes listed above.

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Sequence Number

A code was used to identify the type of sample collected, such as:

GW - Ground water sample;
S - Surface water or sediment sample (definition of which type of sample is in previous qualifier of sample number); and
SS - Subsurface soil sample.

Sample Depth

The depth or depth interval from which the sample was collected, if appropriate.

Split Sampling

Where two sets of samples were collected, the labels HART, for Fred C. Hart Associates, Inc., and USAFOEHL were used to differentiate between samples to be sent to the USAFOEHL laboratory and samples to be sent to HART's subcontracted laboratory (Princeton Testing Laboratory).

Examples

Examples of sample numbers are:

- MAFB, TB-1, SS-5, 20'-22', HART 004. Minot Air Force Base; test boring #1; subsurface soil sample #5; collected from a depth of 20 to 22 feet below the surface; retained by HART; 4th soil sample collected and sent for chemical analysis.

- MAFB, SWD, S1, HART 026. Minot Air Force Base; surface water Sample D; retained by HART; first surface water sample collected at this site; 26th water sample obtained for chemical analysis.

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- MAFB, DW-3, GW-1, HART 013. Minot Air Force Base; Deep Monitoring Well No. 3; first ground water sample collected from this well; retained by HART; 13th water sample collected and sent for chemical analysis.

Blanks, Knowns, Spikes, Splits and Duplicates

QC blank and duplicate samples, sent to the USAFOEHL laboratory and the HART subcontractor, Princeton Testing Laboratory, were given sample numbers similar to those for original samples. The identity of QC duplicate samples was recorded in field log books, but was not marked in any way on the sample containers.

USAFOEHL Samples

Samples sent to the USAFOEHL laboratory were accompanied by the following information:

1. Purpose of sample (analyte);
2 Installation name (base);
3. Sample number (on container);
4. Source/location of sample;
5. Contract task number and title of project;
6. Method of collection (bailer, suction pump, air-lift pump, etc.);
7. Volumes removed before sample taken;
8. Special conditions (use of surrogates, filtering, etc.); and
9. Preservatives used, especially nonstandard types.

SOIL SAMPLING (For Laboratory Chemical Analyses)

A portion of the soil sample, collected from the least disturbed area in the center of the split-spoon, was placed in appropriately labeled VOA vials for OVA headspace analysis, as described previously in this Appendix. The remaining portions of the soil samples were placed in properly labeled, laboratory-prepared glass jars and VOA vials. The VOA

vials retained for OVA headspace analysis were analyzed in the field for the presence of volatile organic compounds and the results were recorded. Based on OVA screening results and other criteria, soil samples were selected for submittal to the laboratories for further analyses.

GROUND WATER MONITORING AND SAMPLING

Ground Water Level Measurements

Following completion of well installations, the ground water levels in all wells were measured within a 24-hour period, thus constituting a single round of ground water level measurements. The instrument probe (M-scope: Slope Indicator Co., Model 51453) was lowered down the well and the depth to water was measured from the top of the PVC casing at the marked reference point. When the electrode of the M-scope came into contact with water, an audible signal was emitted. A properly cleaned surveyors tape was used to sound the bottom of the well.

Ground Water Sampling

In order for valid, representative ground water samples to be collected from the monitoring wells, it was important to properly prepare the well prior to sample collection. This preparation entailed removing all the water which was standing in the casing and grabbing the sample from water which had recently been recharged from the aquifer. To accomplish this, the depth to water from the top of the PVC casing was measured. This value was used in conjunction with the total casing length to determine the height of the water column. The volume of water standing in the well was then calculated. At least three times this volume was removed or the well was bailed dry, except for the COE well where limited access prevented bailing.

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Once the well was adequately evacuated, sample collection was then accomplished by lowering a stainless steel, bottom loading bailer with a teflon check valve into the well. Each bailer was fitted with a dedicated piece of polypropylene rope. A decontaminated bailer was used in each well. If the bailer had not been used for well evacuation, the first bail of water was discarded to rinse off any cleaning agents which may still have been present on the bailer. The samples were poured directly from the bailers into clean sample jars for temperature, pH and specific conductance measurements and into laboratory-prepared sample bottles and VOA vials for subsequent laboratory analyses.

Samples bottles were placed in a cooler at 4°C. Coolers were sealed and shipped overnight to the designated laboratory. Duplicates of ten percent of the samples were obtained and shipped to USAFOEHL. Proper chain-of-custody procedures were followed when transferring the samples from the field to the laboratory. In addition, accurate records were kept of all sampling activities and included the following information: date, time, location, sample number, depth to water measurement, method and volume of water evacuation and sampling techniques.

APPENDIX F.2

SAMPLE IDENTIFICATION
CROSS REFERENCE AND DATES OF SAMPLE ANALYSES

(CL5060B/0528N)

TABLE F.2.1

SAMPLE IDENTIFIER AND ANALYTICAL RESULTS CROSS-REFERENCE

Sample-Identifier Cross-Reference			Cross-Reference Analytical Results Reports To Appendices						
HART SAMPLE NUMBER	PTL SAMPLE NUMBER	PTL JOB NUMBER	PRIORITY POLLUTANT METALS	TOTAL DISSOLVED SOLIDS AND COMMON ANIONS	TOTAL PETROLEUM HYDROCARBONS	AROMATIC VOLATILE ORGANICS	HALOGENATED VOLATILE ORGANICS	ACID EXTRACTABLE ORGANICS	BASE/ NEUTRAL EXTRACTABLE ORGANICS
MAFB, SW-1 GW-1 HART 001	SN001	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c.	H.3.c	H.3.d
MAFB, DW-1 GW-1 HART 003	SN003	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c	H.3.c	H.3.d
MAFB, SW-3 GW-1 HART 004	SN004	86GW3506	H.6	H.8	H.4	H.1.a	H.1.a	H.3.a	H.3.b
MAFB, SW-4 GW-1 HART 005	SN005	86GW3506	H.6	H.8	H.4	H.1.a	H.1.a	H.3.a	H.3.b
MAFB, SW-5 GW-1 HART 006	SN006	86GW3506	H.6	H.8	H.4	H.1.a	H.1.a	H.3.a	H.3.b
MAFB, SW-6 GW-1 HART 007	SN007	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c	H.3.c	H.3.d

Table continued on next page; Legend appears on last page of table.

(CL5141A/9)

TABLE F.2.1 (Continued)

SAMPLE IDENTIFIER AND ANALYTICAL RESULTS CROSS-REFERENCE

Sample-Identifier Cross-Reference			Cross-Reference Analytical Results Reports To Appendices						
HART SAMPLE NUMBER	PTL SAMPLE NUMBER	PTL JOB NUMBER	PRIORITY POLLUTANT METALS	TOTAL DISSOLVED SOLIDS AND COMMON ANIONS	TOTAL PETROLEUM HYDROCARBONS	AROMATIC VOLATILE ORGANICS	HALOGENATED VOLATILE ORGANICS	ACID EXTRACTABLE ORGANICS	BASE/ NEUTRAL EXTRACTABLE ORGANICS
MAFB, SW-8 GW-1 HART 008	SN008	86GW3523	H.6 (Lead only)	NA	H.4	H.1.b	H.1.c	NA	NA
MAFB, SW-9 GW-1 HART 009	SN009	86GW3506	H.6 (Lead only)	NA	H.4	H.1.a	H.1.a	NA	NA
MAFB, SW-9 GW-2 HART 010	SN010	86GW3506	H.6 (Lead only)	NA	H.4	H.1.a	H.1.a	NA	NA
MAFB, FTA Ground Water Equipment Blank Hart 011	SN011	86GW3506	H.6 (Lead only)	NA	H.4	H.1.a	H.1.a	NA	NA
MAFB, DW-2 GW-1 HART 012	SN012	86GW3506	H.6	H.8	H.4	H.1.a	H.1.a	H.3.a	H.3.b
MAFB, DW-3 GS-1 HART 013	SN013	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c	H.3.c	H.3.d

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(CL5141A/9)

TABLE F.2.1 (Continued)

SAMPLE IDENTIFIER AND ANALYTICAL RESULTS CROSS-REFERENCE

Sample-Identifier Cross-Reference			Cross-Reference Analytical Results Reports To Appendices						
HART SAMPLE NUMBER	PTL SAMPLE NUMBER	PTL JOB NUMBER	PRIORITY POLLUTANT METALS	TOTAL DISSOLVED SOLIDS AND COMMON ANIONS	TOTAL PETROLEUM HYDROCARBONS	AROMATIC VOLATILE ORGANICS	HALOGENATED VOLATILE ORGANICS	ACID EXTRACTABLE ORGANICS	BASE/ NEUTRAL EXTRACTABLE ORGANICS
MAFB, DW-4 GW-1 HART 014	SN014	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c	H.3.c	H.3.d
MAFB, SLA Equipment Blank HART 015	SN015	86GW3506	H.6	H.8	H.4	H.1.a	H.1.a	H.3.a	H.3.b
MAFB, MW-1 GW-1 HART 017	SN017	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c	H.3.c	H.3.d
MAFB, MW-2 GW-1 HART 018	SN018	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c	H.3.c	H.3.d
MAFB, MW-3 GW-1 HART 019	SN019	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c	H.3.c	H.3.d
MAFB, MW-4 GW-1 HART 020	SN020	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c	H.3.c	H.3.d

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(CL5141A/9)

TABLE F.2.1 (Continued)

SAMPLE IDENTIFIER AND ANALYTICAL RESULTS CROSS-REFERENCE

Sample-Identifier Cross-Reference			Cross-Reference Analytical Results Reports To Appendices						
HART SAMPLE NUMBER	PTL SAMPLE NUMBER	PTL JOB NUMBER	PRIORITY POLLUTANT METALS	TOTAL DISSOLVED SOLIDS AND COMMON ANIONS	TOTAL PETROLEUM HYDROCARBONS	AROMATIC VOLATILE ORGANICS	HALOGENATED VOLATILE ORGANICS	ACID EXTRACTABLE ORGANICS	BASE/ NEUTRAL EXTRACTABLE ORGANICS
MAFB, DW-5 GW-1 HART 021	SN021	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c	H.3.c	H.3.d
MAFB, COE GW-1 HART 022	SN022	86GW3523	H.6	H.8	H.4	H.1.b	H.1.c	H.3.c	H.3.d
MAFB, SWA S-1 HART 023	SN023	86GW3538	H.6	H.8	H.4	H.1.d	H.1.e	H.3.e	H.3.f
MAFB, SWB S-1 HART 024	SN024	86GW3538	H.6	H.8	H.4	h.1.d	H.1.e	H.3.e	H.3.f
MAFB, SWC S-1 HART 025	SN025	86GW3538	H.6	H.8	H.4	H.1.d	H.1.e	H.3.e	H.3.f
MAFB, SWD S-1 HART 026	SN026	86GW3538	H.6	H.8	H.4	H.1.d	H.1.e	H.3.e	H.3.f
MAFB, SWE S-1 HART 027	SN027	86GW3538	H.6	H.8	H.4	NA	NA	H.3.e	H.3.f

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(CL5141A/9)

TABLE F.2.1 (Continued)

SAMPLE IDENTIFIER AND ANALYTICAL RESULTS CROSS-REFERENCE

Sample-Identifier Cross-Reference			Cross-Reference Analytical Results Reports To Appendices						
HART SAMPLE NUMBER	PTL SAMPLE NUMBER	PTL JOB NUMBER	PRIORITY POLLUTANT METALS	TOTAL DISSOLVED SOLIDS AND COMMON ANIONS	TOTAL PETROLEUM HYDROCARBONS	AROMATIC VOLATILE ORGANICS	HALOGENATED VOLATILE ORGANICS	ACID EXTRACTABLE ORGANICS	BASE/ NEUTRAL EXTRACTABLE ORGANICS
MAFB, TB-1 SS-2, 5'-7' HART 001	HART 001	86GW3440	H.7 (Lead only)	NA	H.5	H.2	H.2	NA	NA
MAFB, TB-1 SS-3, 10'-12' HART 002	HART 002	86GW3440	H.7 (Lead only)	NA	H.5	H.2	H.2	NA	NA
MAFB, TB-1 SS-4, 15'-17' HART 003	HART 003	86GW3440	H.7 (Lead only)	NA	H.5	H.2	H.2	NA	NA
MAFB, TB-1 SS-5, 20'-22' HART 004	HART 004	86GW3440	H.7 (Lead only)	NA	H.5	H.2	H.2	NA	NA
MAFB, SD-1 S-2, 0.5'-1.0' HART 005	HART 005	86GW3440	H.7 (Lead only)	NA	H.5	H.2	H.2	NA	NA
MAFB, SD-2 S-1, 0-0.5' HART 006	HART 006	86GW3440	H.7 (Lead only)	NA	H.5	H.2	H.2	NA	NA
MAFB, SD-3 S-1, 0-0.5' HART 007	HART 007	86GW3440	H.7 (Lead only)	NA	H.5	H.2	H.2	NA	NA

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(CL5141A/9)

TABLE F.2.1 (Continued)

SAMPLE IDENTIFIER AND ANALYTICAL RESULTS CROSS-REFERENCE

Sample-Identifier Cross-Reference			Cross-Reference Analytical Results Reports To Appendices						
HART SAMPLE NUMBER	PTL SAMPLE NUMBER	PTL JOB NUMBER	PRIORITY POLLUTANT METALS	TOTAL DISSOLVED SOLIDS AND COMMON ANIONS	TOTAL PETROLEUM HYDROCARBONS	AROMATIC VOLATILE ORGANICS	HALOGENATED VOLATILE ORGANICS	ACID EXTRACTABLE ORGANICS	BASE/ NEUTRAL EXTRACTABLE ORGANICS
MAFB, SD-4 S-1, 0.5'-1.0' HART 008*	HART 008	86GW3440	H.7 (Lead only)	NA	H.5	H.2	H.2	NA	NA
MAFB, TB-2 SS-2, 5'-7' HART 009	HART 009	86GW3441	H.7	NA	H.5	NA	NA	NA	NA
MAFB, TB-2 SS-5, 18'-20' HART 010	HART 010	86GW3441	H.7	NA	H.5	NA	NA	NA	NA
MAFB, TB-2 SS-6, 18'-20' HART 011	HART 011	86GW3441	H.7	NA	H.5	NA	NA	NA	NA

Legend:

MAFB - Minot Air Force Base
GW - Ground Water
SW - Shallow well or Surface water
DW - Deep Well
SN - Sample Number
PTL - Princeton Testing Laboratory
S - Sample
TB - Test Boring
SS - Soil Sample
* - Sample incorrectly labelled "SD-4, S-1", correct sample identifier is "SD-2, S-2."

(CL5141A/9)

TABLE F.2.2

METHOD DETECTION LIMITS FOR
AROMATIC VOLATILE ORGANIC ANALYSIS OF
WATER SAMPLES (ug/l)

Compound	MDL(1)	PQL(2)	CRDL(3)	PTLMDL(4)
Benzene	0.2	2	5	1
Toluene	0.2	2	5	1
Chlorobenzene	0.2	2	5	1
Ethylbenzene	0.2	2	5	1
1,3-dichlorobenzene	0.4	4	10	1
1,2-dichlorobenzene	0.4	4	10	1
1,4-dichlorobenzene	0.3	3	10	1

Notes:

(1) Method Detection Limits, from: "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater: Method 602 - Purgeable Aromatics," 49 CFR 43250, October 26, 1984.

(2) Practical Quantitation Limits, from: "Test Methods for Evaluating Solid Waste (SW846): Method 8020 - Aromatic Volatile Organics."

(3) Contract Required Detection Limits, from: "USEPA Contract Laboratory Program, Statement of Work for Organics Analysis," July, 1987.

(4) Method Detection Limits as reported by Princeton Testing Laboratory.

Legend:

ug/l - micrograms per liter

(CL5140A/7)

TABLE F.2.3

METHOD DETECTION LIMITS FOR
HALOGENATED VOLATILE ORGANIC ANALYSIS OF
WATER SAMPLES (ug/l)

Compound	MDL(1)	PQL(2)	CRDL(3)	PTLMDL(4)
Chloromethane	0.08	0.8	10	20
Bromomethane	1.18	11.8	10	10
Dichlorodifluoromethane	1.81	18.1	NA	5
Vinyl chloride	0.18	1.8	10	2
Chloroethane	0.52	5.2	10	2
Methylene chloride	0.25	2.5	5	5
Trichlorofluoromethane	NA	NA	NA	5
1,1-Dichloroethene	0.13	1.3	5	1
1,1-Dichloroethane	0.07	0.7	5	1
Trans-1,2-dichloroethene	0.10	1.0	5	1
Chloroform	0.05	0.5	5	2
1,2-Dichloroethane	0.03	0.3	5	1
1,1,1-Trichloroethane	0.03	0.3	5	2
Carbon tetrachloride	0.12	1.2	5	2
Bromodichloromethane	0.10	1.0	5	2
1,2-Dichloropropane	0.04	0.4	5	1
Trans-1,3-dichloropropene	0.20	2.0	5	5
Trichloroethene	0.12	1.2	5	2
Dibromochloromethane	0.09	0.9	5	2
1,1,2-Trichloroethane	0.02	0.2	5	5
Cis-1,3-dichloropropene	0.34	3.4	5	5
2-Chloroethylvinylether	0.13	1.3	NA	5
Bromoform	0.20	2.0	5	10
1,1,2,2-Tetrachloroethane	0.03	0.3	5	10
Tetrachloroethene	0.03	0.3	5	2

Notes:

(1) Method Detection Limits, from: "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater: Method 601 - Purgeable Halocarbons," 49 CFR 43250, October 26, 1984.

(2) Practical Quantitation Limits, from: "Test Methods for Evaluating Solid Waste (SW 846): Method 8010 - Halogenated Volatile Organics."

(3) Contract Required Detection Limits, from: "USEPA Contract Laboratory Program, Statement of Work for Organics Analysis, July, 1987.

(4) Method Detection Limits as reported by Princeton Testing Laboratory.

Legend:

ug/l - micrograms per liter
NA - Not Applicable

(CL5140A/7)

TABLE F.2.4

METHOD DETECTION LIMITS FOR AROMATIC VOLATILE ORGANIC ANALYSIS OF SOIL AND SEDIMENT SAMPLES (ug/kg)

Compound	MDL(1)	PQL-Low Level Soil (1)	PQL-High Level Soil (1)	CRDL-Low Level Soil (2)	PTLMDL (3)
Benzene	0.2	2	250	5	40
Chlorobenzene	0.2	2	250	5	40
1,2-dichlorobenzene	0.3	3	375	N/A	40
1,3-dichlorobenzene	0.4	4	500	N/A	40
1,4-dichlorobenzene	0.4	4	500	N/A	40
Ethylbenzene	0.2	2	250	5	40
Toluene	0.2	2	250	N/A	40

Notes:

(1) Method Detection Limits (MDL) and Practical Quantitation Limits (PQL) from: "Test Methods for Evaluating Solid Waste (SW846): Method 8020 - Aromatic Volatile Organics."

(2) Contract Required Detection Limits, from: "USEPA Contract Laboratory Program, Statement of Work for Organics Analysis," *July 1987*.

(3) Method Detection Limits as reported by Princeton Testing Laboratory.

Legend:

ug/kg - micrograms per kilogram
N/A - Not Applicable

(CL5056B/19)

TABLE F.2.5

METHOD DETECTION LIMITS FOR
HALOGENATED VOLATILE ORGANICS ANALYSIS
OF SOIL AND SEDIMENT SAMPLES (ug/kg)

Compound	MDL(1)	PQL-Low Level Soil(1)	PQL-High Level Soil(1)	CRDL-Low Level Soil(2)	PTLMDL(3)
Chloromethane	0.08	0.8	100	10	800
Bromomethane	NA	NA	NA	10	400
Dichlorodifluoromethane	NA	NA	NA	NA	200
Vinyl chloride	0.18	1.8	230	10	80
Chloroethane	0.52	5.2	650	10	80
Methylene chloride	NA	NA	NA	5	200
Trichlorofluoromethane	NA	NA	NA	NA	200
1,1-Dichloroethene	0.13	1.3	160	5	40
1,1-Dichloroethane	0.07	0.7	88	5	40
Trans-1,2-dichloroethene	0.10	1.0	130	5	40
Chloroform	0.05	0.5	63	5	40
1,2-Dichloroethane	0.03	0.3	38	5	40
1,1,1-Trichloroethane	0.03	0.3	38	5	80
Carbon tetrachloride	0.12	1.2	150	5	80
Bromodichloromethane	0.10	1.0	130	5	80
1,2-Dichloropropane	0.04	0.4	50	5	40
Trans-1,3-dichloropropene	0.34	3.4	430	5	200
Trichloroethene	0.12	1.2	150	5	80
Dibromochloromethane	0.09	0.9	113	5	80
1,1,2-Trichloroethane	0.02	0.2	25	5	200
cis-1,3-Dichloropropene	0.34	3.4	430	5	200

Table continued on next page; Legend and notes appear on next page.

TABLE F.2.5 (Continued)

METHOD DETECTION LIMITS FOR
HALOGENATED VOLATILE ORGANICS ANALYSIS
OF SOIL AND SEDIMENT SAMPLES (ug/kg)

Compound	MDL(1)	PQL-Low Level Soil(1)	PQL-High Level Soil(1)	CRDL-Low Level Soil(2)	PTLMDL(3)
2-Chloroethylvinylether	0.13	1.3	160	NA	200
Bromoform	0.20	2.0	250	5	400
1,1,2,2-Tetrachloroethane	0.03	0.3	38	5	400
Tetrachloroethene	0.03	0.3	38	5	80

Notes:

(1) Method Detection Limits (MDL) and Practical Quantitation Limits (PQL) from: "Test Methods for Evaluating Solid Waste (SW 846): Method 8010 - Halogenated Volatile Organics," 49 CFR 43250, October 26, 1984.

(2) Contract Required Detection Limits, from: "USEPA Contract Laboratory Program, Statement of Work for Organics Analysis," July, 1987.

(3) Method Detection Limits as reported by Princeton Testing Laboratory.

Legend:

ug/kg - micrograms per kilogram
NA - Not Applicable

(CL5140A/12)

TABLE F.2.6

METHOD DETECTION LIMITS FOR
ACID AND BASE/NEUTRAL EXTRACTABLE
PRIORITY POLLUTANT ORGANIC ANALYSES OF
WATER SAMPLES (ug/l)

Compound	MDL(1)	PQL(2)	CRDL(3)	PTLMDL(4)
Acenaphthene	1.9	19	10	10
Acenaphthylene	3.5	35	10	10
Anthracene	1.9	19	10	10
Benzidine	44.0	440	NA	100
Benzo(a)Anthracene	7.8	78	10	10
Benzo(a)Pyrene	2.5	25	NA	10
Benzo(b)Fluoranthene	4.8	48	10	10
Benzo(ghi)Perylene	4.1	41	NA	10
Benzo(k)Fluoranthene	2.5	25	NA	10
Bis-(2-Chloroethoxy)Methane	5.3	53	10	10
Bis-(2-Chloroethyl)Ether	5.7	57	10	10
Bis(2-Chloroisopropyl)Ether	5.7	57	10	10
Bis(2-Ethylhexyl)Phthalate	149.0	25	10	10
4-Bromophenyl Phenyl Ether	1.9	19	10	10
Butyl Benzyl Phthalate	2.5	25	10	10
2-Chloronaphthalene	1.9	19	10	10
4-Chlorophenyl Phenyl Ether	4.2	42	10	10
Chrysene	2.5	25	10	10
Dibenzo(a,h)Anthracene	2.5	25	NA	10
1,2-Dichlorobenzene	1.9	19	10	10
1,3-Dichlorobenzene	1.9	19	10	10
1,4-Dichlorobenzene	4.4	44	10	10
3,3-Dichlorobenzidine	16.5	165	20	20
Diethyl Phthalate	1.9	19	10	10
Dimethyl Phthalate	1.6	16	10	10
Di-n-Butyl Phthalate	2.5	25	10	10
2,4-Dinitrotoluene	5.7	57	10	10
2,6-Dinitrotoluene	1.9	19	10	10
Di-n-Octylphthalate	2.5	25	10	10
1,2-Diphenylhydrazine	NA	NA	NA	10
Fluoranthene	2.2	22	10	10
Fluorene	1.9	19	10	10
Hexachlorobenzene	1.9	19	10	10
Hexachlorobutadiene	0.9	9	10	10
Hexachlorocyclopentadiene	NA	NA	10	10
Hexachloroethane	1.6	16	10	10
Indeno(1,2,3-cd)Pyrene	3.7	37	NA	10
Isophorone	2.2	22	10	10
Naphthalene	1.6	16	10	10
Nitrobenzene	1.9	19	10	10

Table continued on next page;
Legend and notes appear on last page of table.

TABLE F.2.6 (Continued)

METHOD DETECTION LIMITS FOR
ACID AND BASE/NEUTRAL EXTRACTABLE
PRIORITY POLLUTANT ORGANIC ANALYSES OF
WATER SAMPLES (ug/l)

Compound	MDL(1)	PQL(2)	CRDL(3)	PTLMDL(4)
N-Nitrosodimethylamine	NA	NA	NA	10
N-Nitrosodi-n-Propylamine	NA	NA	10	10
N-Nitrosodiphenylamine	1.9	19	10	10
Phenanthrene	5.4	54	10	10
Pyrene	1.9	19	10	10
1,2,4-Trichlorobenzene	1.9	19	10	10
2-Chlorophenol	3.3	33	10	10
2,4-Dichlorophenol	2.7	27	10	10
2,4-Dimethylphenol	2.7	240	10	10
4,6-Dinitro-2-Cresol	NA	NA	50	50
2,4-Dinitrophenol	42.0	420	50	50
2-Nitrophenol	3.6	36	10	10
4-Nitrophenol	2.4	24	50	50
4-Chloro-3-Cresol	NA	30	10	10
Pentachlorophenol	3.6	36	50	50
Phenol	1.5	15	10	10
2,4,6-Trichlorophenol	2.7	27	10	10

Notes:

(1) Method Detection Limits, from: "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater: Method 625 - Base/Neutrals and Acids," 49 CFR 43250, October 26, 1984.

(2) Practical Quantitation Limits, from: "Test Methods for Evaluating Solid Wastes (SW 846): Method 8250 - Semivolatile Organics."

(3) Contract Required Detection Limits, from: "USEPA Contract Laboratory Program, Statement of Work for Organic Analysis," July, 1987.

(4) Method Detection Limits as reported by Princeton Testing Laboratory.

Legend:

ug/l - micrograms per liter
NA - Not Applicable

(CL5140A/7)

TABLE F.2.7

METHOD DETECTION LIMITS FOR PRIORITY POLLUTANT METALS ANALYSES OF WATER SAMPLES (mg/l)

Metal	Method(1)	SOWMDL(2)	CRDL(3)	PTLMDL(4)
Beryllium	EPA 210.1	0.0003	0.005	0.05
Cadmium	EPA 213.1	0.004	0.005	0.005
Chromium	EPA 218.1	0.007	0.010	0.02
Copper	EPA 220.1	0.006	0.025	0.02
Nickel	EPA 249.1	0.015	0.040	0.01
Lead	EPA 239.1	0.042	0.005	0.02
Zinc	EPA 289.1	0.002	0.020	0.02
Arsenic	EPA 206.2	0.001	0.010	0.01
Silver	EPA 272.1	0.007	0.010	0.01
Selenium	EPA 270.2	0.002	0.005	0.01
Thallium	EPA 279.1	0.040	0.010	0.01
Mercury	EPA 245.1	0.0002	0.0002	0.001
Antimony	EPA 204.1	0.032	0.06	0.10

Notes:

(1) Analytical method used by Princeton Testing Laboratory in analysis of the specified metal.
(2) Detection Limits applicable to the analytical methods specified in the USAF MAFB IRP Phase II Statement of Work.
(3) Contract Required Detection Limits, from: "USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis," July 1987.
(4) Method Detection Limits as reported by Princeton Testing Laboratory.

Legend:

mg/l - milligrams per liter

(CL5056B/25)

TABLE F.2.8

METHOD DETECTION LIMITS FOR PRIORITY POLLUTANT METALS ANALYSES OF SOIL AND SEDIMENT SAMPLES (mg/kg)

Metal	Method	SOWMDL(1)	PTLMDL(2)
Beryllium	SW-846/7090	0.03	2.5
Cadmium	SW-846/7130	0.4	0.5
Chromium	SW-846/7190	0.7	1.0
Copper	SW-846/7210	0.6	1.0
Nickel	SW-846/7520	1.5	2.0
Lead	SW-846/7420	4.2	2.0
Zinc	SW-846/7950	0.2	0.5
Arsenic	SW-846/7060	0.1	0.5
Silver	SW-846/7760	0.7	0.5
Selenium	SW-846/7740	0.2	0.5
Thallium	SW-846/7840	4.0	5.0
Mercury	SW-846/7470	0.1	0.1
Antimony	SW-846/7040	3.2	10.0

Notes:

(1) Method Detection Limits specified in the Statement of Work (SOW).

(2) Method Detection Limits as reported by Princeton Testing Laboratory.

Legend:

mg/kg - milligrams per kilogram

(CL5056B/19)

TABLE F.2.9

METHOD DETECTION LIMITS FOR TOTAL PETROLEUM HYDROCARBON ANALYSIS (EPA 418.1) OF WATER SAMPLES

HART Sample Number	SOWMDL (mg/l)(1)	PTLMDL (mg/l)(2)
001	1	0.5
003	1	0.5
004	1	0.5
005	1	0.5
006	1	0.5
007	1	0.5
008	1	0.5
009	1	0.5
010	1	0.5
011	1	1.0(3)
012	1	0.5
013	1	2.0(3)
014	1	0.5
015	1	0.5
017	1	0.5
018	1	0.5
019	1	0.5
020	1	4.0(3)
021	1	0.5
022	1	0.5
023	1	0.5
024	1	0.5
025	1	0.5
026	1	0.5
027	1	0.5

Notes:

(1) Detection Limit applicable to the analytical method specified in the USAF MAFB IRP Phase II Statement of Work (EPA 418.1).
(2) Method Detection Limits as reported by Princeton Testing Laboratory.
(3) Higher detection limits due to the lesser volume of sample available for analysis.

Legend:

mg/l - milligrams per liter

(CL5056B/20)

TABLE F.2.10

METHOD DETECTION LIMITS FOR TOTAL PETROLEUM HYDROCARBON ANALYSIS (EPA 418.1) OF SOIL AND SEDIMENT SAMPLES

SOWMDL(1)	PTLMDL(2)
1 mg/kg	10.0 mg/kg

Notes:

(1) Detection Limit applicable to the analytical method specified in the USAF MAFB IRP Phase II Statement of Work.
(2) Method Detection Limits as reported by Princeton Testing Laboratory.

Legend:

mg/kg - milligrams per kilogram

(CL5056B/20)

TABLE F.2.11

METHOD DETECTION LIMITS FOR TOTAL DISSOLVED SOLIDS AND COMMON ANIONS ANALYSES OF WATER SAMPLES

Parameter	Method(1)	SOWMDL (mg/l)(2)	PTLMDL (mg/l)(3)
Chloride	SM 407A	0.1	1.0
Fluoride	EPA 340.1	0.1	0.1
Bromide	SM 405	0.1	0.1
Nitrate Nitrogen	EPA 352.1	0.1	0.1
Nitrite Nitrogen	SM 419	0.1	0.01
Phosphate	EPA 365.2	0.1	0.1
Sulfate	EPA 375.4	0.1	1.0
Total Dissolved Solids	EPA 160.1	10	2.0

Notes:

(1) Analytical Method used by Princeton Testing Laboratory in analysis of the specified parameter.
(2) Detection Limits applicable to the analytical methods specified in the USAF MAFB IRP Phase II Statement of Work.
(3) Method Detection Limits as reported by Princeton Testing Laboratory.

Legend:

mg/l - milligrams per liter

(CL5056B/19)

TABLE F.2.12

SAMPLE CHRONOLOGIES FOR AROMATIC AND HALOGENATED VOLATILE ORGANIC ANALYSES OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Date Analyzed	Actual Holding Time (days)
001	Ground Water	10/30/86	10/31/86	11/12/86	13
003	Ground Water	10/30/86	10/31/86	11/12/86	13
004	Ground Water	10/29/86	10/30/86	11/10/86	12
005	Ground Water	10/29/86	10/30/86	11/10/86	12
006	Ground Water	10/29/86	10/30/86	11/10/86	12
007	Ground Water	10/30/86	10/31/86	11/12/86	13
008	Ground Water	10/30/86	10/31/86	11/12/86	13
009	Ground Water	10/29/86	10/30/86	11/10/86	12
010	Ground Water	10/29/86	10/30/86	11/11/86	13
011	Ground Water Equipment Blank	10/29/86	10/30/86	11/11/86	13
012	Ground Water	10/29/86	10/30/86	11/11/86	13
013	Ground Water	10/30/86	10/31/86	11/12/86	13
014	Ground Water	10/30/86	10/31/86	11/12/86	13
015	Ground Water Equipment Blank	10/29/86	10/30/86	11/11/86	13

Table continued on next page.

(CL5056B/21)

TABLE F.2.12 (Continued)

SAMPLE CHRONOLOGIES FOR AROMATIC AND HALOGENATED VOLATILE ORGANIC ANALYSES OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Date Analyzed	Actual Holding Time (days)
017	Ground Water	10/30/86	10/31/86	11/12/86	13
018	Ground Water	10/30/86	10/31/86	11/12/86	13
019	Ground Water	10/30/86	10/31/86	11/12/86	13
020	Ground Water	10/30/86	10/31/86	11/13/86	14
021	Ground Water	10/30/86	10/31/86	11/12/86	13
022	Ground Water	10/30/86	10/31/86	11/13/86	14
023	Surface Water	11/2/86	11/3/86	11/13/86	11
024	Surface Water	11/2/86	11/3/86	11/13/86	11
025	Surface Water	11/2/86	11/3/86	11/13/86	11
026	Surface Water	11/2/86	11/3/86	11/13/86	11

(CL5056B/21)

TABLE F.2.13

SAMPLE CHRONOLOGIES FOR AROMATIC AND HALOGENATED VOLATILE ORGANIC ANALYSES OF SOIL AND SEDIMENT SAMPLES

HART Sample Number	Type Of Sample	Date Collected	Date Received by Laboratory	Date Analyzed	Date of Confirmatory Analysis	Actual Holding Time* (days)
001	Subsurface Soil	10/22/86	10/27/86	11/3/86	-	12
002	Subsurface Soil	10/22/86	10/27/86	11/3/86	11/5/86	12 (14)
003	Subsurface Soil	10/22/86	10/27/86	11/3/86	11/5/86	12 (14)
004	Subsurface Soil	10/22/86	10/27/86	11/3/86	-	12
005	Surface Sediment	10/23/86	10/27/86	11/3/86	11/5/86	11 (13)
006	Surface Sediment	10/23/86	10/27/86	11/4/86	-	12
007	Surface Sediment	10/23/86	10/27/86	11/4/86	11/5/86	12 (13)
008	Surface Sediment	10/23/86	10/27/86	11/4/86	-	12

Legend:

* - Values appearing in parentheses are actual holding times for confirmatory analysis.

(CL5056B/22)

TABLE F.2.14

SAMPLE CHRONOLOGIES FOR ACID AND BASE NEUTRAL EXTRACTABLE PRIORITY POLLUTANT ORGANIC ANALYSES OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Date Extracted	Date Analyzed	Holding Time Prior to Extraction(days)	Holding Time Prior to Analysis (days)
001	Ground Water	10/30/86	10/31/86	11/5/86	11/11/86	6	12
003	Ground Water	10/30/86	10/31/86	11/5/86	11/11/86	6	12
004	Ground Water	10/29/86	10/30/86	11/11/86	11/11/86	13	13
005	Ground Water	10/29/86	10/30/86	11/11/86	11/12/86	13	14
006	Ground Water	10/29/86	10/30/86	11/11/86	11/12/86	13	14
007	Ground Water	10/30/86	10/31/86	11/5/86	11/12/86	6	13
012	Ground Water	10/29/86	10/30/86	11/11/86	11/12/86	13	14
013	Ground Water	10/30/86	10/31/86	11/5/86	11/12/86	6	13
014	Ground Water	10/30/86	10/31/86	11/5/86	11/11/86	6	12
015	Ground Water Equipment Blank	10/29/86	10/30/86	11/11/86	11/12/86	13	14
017	Ground Water	10/30/86	10/31/86	11/5/86	11/12/86	6	13
018	Ground Water	10/30/86	10/31/86	11/5/86	11/11/86	6	12
019	Ground Water	10/30/86	10/31/86	11/5/86	11/12/86	6	13
020	Ground Water	10/30/86	10/31/86	11/5/86	11/12/86	6	13

Table continued on next page.

(CL5056B/23)

TABLE F.2.14 (Continued)

SAMPLE CHRONOLOGIES FOR ACID AND BASE NEUTRAL EXTRACTABLE PRIORITY POLLUTANT ORGANIC ANALYSES OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Date Extracted	Date Analyzed	Holding Time Prior to Extraction(days)	Holding Time Prior to Analysis (days)
021	Ground Water	10/30/86	10/31/86	11/5/86	11/11/86	6	13
023	Surface Water	11/2/86	11/3/86	11/6/86	11/11/86	4	9
024	Surface Water	11/2/86	11/3/86	11/6/86	11/11/86	4	9
025	Surface Water	11/2/86	11/3/86	11/6/86	11/11/86	4	9
026	Surface Water	11/2/86	11/3/86	11/6/86	11/12/86	4	10
027	Surface Water	11/2/86	11/3/86	11/6/86	11/11/86	4	9

(CL5056B/23)

TABLE F.2.15

SAMPLE CHRONOLOGIES FOR PRIORITY POLLUTANT METALS
ANALYSES OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received By Laboratory	Date of Digestion	Metals Analyzed	Date Analyzed	Actual Holding Time (days)
001	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd Cr,Cu,Ni,Ag	11/5-6/86	7
					Hg	11/07/86	8
003	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/5-6/86	7
					Hg	11/07/86	8
004	Ground Water	10/29/86	10/30/86	10/31/86	Be,Pb,Zn,As Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/4-6/86	8
					Hg,	11/07/86	9
005	Ground Water	10/29/86	10/30/86	10/31/86	Be,Pb,Zn,As Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/4-6/86	8
					Hg	11/07/86	9
006	Ground Water	10/29/86	10/30/86	10/31/86	Be,Pb,Zn,As Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/4-6/86	8
					Hg	11/07/86	9

Table continued on next page; Legend appears on last page of table.

(CL5140A/13)

TABLE F.2.15 (Continued)

SAMPLE CHRONOLOGIES FOR PRIORITY POLLUTANT METALS
ANALYSES OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received By Laboratory	Date of Digestion	Metals Analyzed	Date Analyzed	Actual Holding Time (days)
007	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/5-6/86	7
					Hg	11/07/86	8
008	Ground Water	10/30/86	10/31/86	11/03/86	Pb	11/5-6/86	7
009	Ground Water	10/29/86	10/30/86	10/31/86	Pb	11/4-6/86	8
010	Ground Water	10/29/86	10/30/86	10/31/86	Pb	11/4-6/86	8
011	Ground Water Equipment Blank	10/29/86	10/30/86	10/31/86	Pb	11/4-6/86	8
012	Ground Water	10/29/86	10/30/86	10/31/86	Be,Pb,Zn,As Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/4-6/86	8
					Hg	11/07/86	9
013	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd Cr,Cu,Ni,Ag	11/5-6/86	7
					Hg	11/07/86	8
014	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As, Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/5-6/86	7
					Hg	11/07/86	8

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(CL5140A/13)

TABLE F.2.15 (Continued)

SAMPLE CHRONOLOGIES FOR PRIORITY POLLUTANT METALS
ANALYSES OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received By Laboratory	Date of Digestion	Metals Analyzed	Date Analyzed	Actual Holding Time (days)
015	Ground Water Equipment Blank	10/29/86	10/30/86	10/31/86	Be,Pb,Zn,As Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/4-6/86	8
					Hg	11/07/86	9
017	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/5-6/86	7
					Hg	11/07/86	8
018	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/5-6/86	7
					Hg	11/07/86	8
019	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd Cr,Cu,Ni,Ag	11/5-6/86	7
					Hg	11/07/86	8
020	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd Cr,Cu,Ni,Ag	11/5-6/86	7
					Hg	11/07/86	8
021	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag,	11/5-6/86	7
					Hg	11/07/86	8

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(CL5140A/13)

TABLE F.2.15 (Continued)

SAMPLE CHRONOLOGIES FOR PRIORITY POLLUTANT METALS
ANALYSES OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received By Laboratory	Date of Digestion	Metals Analyzed	Date Analyzed	Actual Holding Time (days)
022	Ground Water	10/30/86	10/31/86	11/03/86	Be,Pb,Zn,As, Sb,Se,Tl,Cd, Cr,Cu,Ni,Ag	11/5-6/86	7
					Hg	11/07/86	8
023	Surface Water	11/02/86	11/03/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd Cr,Cu,Ni,Ag	11/4-6/86	4
					Hg	11/07/86	5
024	Surface Water	11/02/86	11/03/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd Cr,Cu,Ni,Ag	11/4-6/86	4
					Hg	11/07/86	5
025	Surface Water	11/02/86	11/03/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd Cr,Cu,Ni,Ag	11/4-6/86	4
					Hg	11/07/86	5
026	Surface Water	11/02/86	11/03/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd Cr,Cu,Ni,Ag	11/4-6/86	4
					Hg	11/07/86	5

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(CL5140A/13)

TABLE F.2.15 (Continued)

SAMPLE CHRONOLOGIES FOR PRIORITY POLLUTANT METALS
ANALYSES OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received By Laboratory	Date of Digestion	Metals Analyzed	Date Analyzed	Actual Holding Time (days)
027	Surface Water	11/02/86	11/03/86	11/03/86	Be,Pb,Zn,As Sb,Se,Tl,Cd	11/4-6/86	4
					Cr,Cu,Ni,Ag		
					Hg	11/07/86	5

Legend:

Be- Beryllium, Cd- Cadmium, Cr- Chromium,
Cu- Copper, Ni- Nickel, Pb- Lead, Zn- Zinc,
As- Arsenic, Ag- Silver, Se- Selenium,
Tl- Thallium, Hg- Mercury and Sb- Antimony

(CL5140A/13)

TABLE F.2.16

SAMPLE CHRONOLOGIES FOR PRIORITY POLLUTANT
METALS ANALYSES OF SOIL AND SEDIMENT SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Date of Digestion	Metals Analyzed	Date Analyzed	Actual Holding Time (days)
001	Subsurface Soil	10/22/86	10/27/86	10/28/86	Pb	11/05/86	14
002	Subsurface Soil	10/22/86	10/27/86	10/28/86	Pb	11/05/86	14
003	Subsurface Soil	10/22/86	10/27/86	10/28/86	Pb	11/05/86	14
004	Subsurface Soil	10/22/86	10/27/86	10/28/86	Pb	11/05/86	14
005	Surface Sediment	10/23/86	10/27/86	10/28/86	Pb	11/05/86	13
006	Surface Sediment	10/23/86	10/27/86	10/28/86	Pb	11/05/86	13
007	Surface Sediment	10/23/86	10/27/86	10/28/86	Pb	11/05/86	13
008	Surface Sediment	10/23/86	10/27/86	10/28/86	Pb	11/05/86	13

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(CL5141A/6)

TABLE F.2.16 (Continued)

SAMPLE CHRONOLOGIES FOR PRIORITY POLLUTANT
METALS ANALYSES OF SOIL AND SEDIMENT SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Date of Digestion	Metals Analyzed	Date Analyzed	Actual Holding Time (days)
009	Subsurface Soil	10/24/86	10/27/86	10/28/86	Be,Pb,Zn, As,Sb,Se, Tl,Cd,Cr, Cu,Ni,Ag	11/4-6/86	13
					Hg	11/03/86	10
010	Subsurface Soil	10/24/86	10/27/86	10/28/86	Be,Pb,Zn, As,Sb,Se, Tl,Cd,Cr, Cu,Ni,Ag	11/4-6/86	13
					Hg	11/03/86	10
011	Subsurface Soil	10/24/86	10/27/86	10/28/86	Be,Pb,Zn, As,Sb,Se, Tl,Cd,Cr, Cu,Ni,Ag	11/4-6/86	13
					Hg	11/03/86	10

Legend:

Be - Beryllium, Cd - Cadmium, Cr - Chromium,
Cu - Copper, Ni- Nickel, Pb - Lead, Zn - Zinc,
As - Arsenic, Ag - Silver, Se - Selenium,
Ti - Thallium, Hg - Mercury and Sb - Antimony

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TABLE F.2.17

SAMPLE CHRONOLOGIES FOR TOTAL PETROLEUM HYDROCARBON ANALYSIS OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Date Analyzed	Actual Holding Time (days)
001	Ground Water	10/30/86	10/31/86	11/18/86	19
003	Ground Water	10/30/86	10/31/86	11/18/86	19
004	Ground Water	10/29/86	10/30/86	11/18/86	20
005	Ground Water	10/29/86	10/30/86	11/18/86	20
006	Ground Water	10/29/86	10/30/86	11/18/86	20
007	Ground Water	10/30/86	10/31/86	11/18/86	19
008	Ground Water	10/30/86	10/31/86	11/18/86	19
009	Ground Water	10/29/86	10/30/86	11/18/86	20
010	Ground Water	10/29/86	10/30/86	11/18/86	20
011	Ground Water Equipment Blank	10/29/86	10/30/86	11/18/86	20
012	Ground Water	10/29/86	10/30/86	11/18/86	20
013	Ground Water	10/30/86	10/31/86	11/18/86	19
014	Ground Water	10/30/86	10/31/86	11/18/86	19
015	Ground Water Equipment Blank	10/29/86	10/30/86	11/18/86	20
017	Ground Water	10/30/86	10/31/86	11/18/86	19
018	Ground Water	10/30/86	10/31/86	11/18/86	19
019	Ground Water	10/30/86	10/31/86	11/18/86	19

Table continued on next page.

TABLE F.2.17 (Continued)

SAMPLE CHRONOLOGIES FOR TOTAL PETROLEUM HYDROCARBON ANALYSIS OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Date Analyzed	Actual Holding Time (days)
020	Ground Water	10/30/86	10/31/86	11/18/86	19
021	Ground Water	10/30/86	10/31/86	11/18/86	19
022	Ground Water	10/30/86	10/31/86	11/18/86	19
023	Surface Water	11/02/86	11/03/86	11/20/86	18
024	Surface Water	11/02/86	11/03/86	11/20/86	18
025	Surface Water	11/02/86	11/03/86	11/20/86	18
026	Surface Water	11/02/86	11/03/86	11/20/86	18
027	Surface Water	11/02/86	11/03/86	11/20/86	18

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TABLE F.2.18

SAMPLE CHRONOLOGIES FOR TOTAL PETROLEUM HYDROCARBON ANALYSIS OF SOIL AND SEDIMENT SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Date Analyzed	Actual Holding Time (days)
001	Subsurface Soil	10/22/86	10/27/86	11/06/86	15
002	Subsurface Soil	10/22/86	10/27/86	11/06/86	15
003	Subsurface Soil	10/22/86	10/27/86	11/06/86	15
004	Subsurface Soil	10/22/86	10/27/86	11/06/86	15
005	Surface Sediment	10/23/86	10/27/86	11/06/86	14
006	Surface Sediment	10/23/86	10/27/86	11/06/86	14
007	Surface Sediment	10/23/86	10/27/86	11/06/86	14
008	Surface Sediment	10/23/86	10/27/86	11/06/86	14
009	Subsurface Soil	10/24/86	10/27/86	11/19/86	26
010	Subsurface Soil	10/24/86	10/27/86	11/19/86	26
011	Subsurface Soil	10/24/86	10/27/86	11/19/86	26

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TABLE F.2.19

SAMPLE CHRONOLOGIES FOR COMMON ANIONS ANALYSES
OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Anion Analyzed	Date Analyzed	Actual Holding Time (days)
001	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/66	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21
003	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/86	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21
004	Ground Water	10/29/86	10/30/86	nitrate nitrogen	10/30/86	1
				nitrite nitrogen	10/30/86	1
				bromide	11/03/86	5
				chloride	11/04/86	6
				fluoride	11/19/86	21
				phosphate	11/19/66	21
				sulfate	11/20/86	22

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(CL5141A/10)

TABLE F.2.19 (Continued)

SAMPLE CHRONOLOGIES FOR COMMON ANIONS ANALYSES
OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Anion Analyzed	Date Analyzed	Actual Holding Time (days)
005	Ground Water	10/29/86	10/30/86	nitrate nitrogen	10/30/86	1
				nitrite nitrogen	10/30/86	1
				bromide	11/03/86	5
				chloride	11/04/86	6
				fluoride	11/19/86	21
				phosphate	11/19/86	21
				sulfate	11/20/86	22
006	Ground Water	10/29/86	10/30/86	nitrate nitrogen	10/30/86	1
				nitrite nitrogen	10/30/86	1
				bromide	11/03/86	5
				chloride	11/04/86	6
				fluoride	11/19/86	21
				phosphate	11/19/86	21
				sulfate	11/20/86	22
007	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/86	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21

Table continued on next page.

(CL5141A/10)

TABLE F.2.19 (Continued)

SAMPLE CHRONOLOGIES FOR COMMON ANIONS ANALYSES
OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Anion Analyzed	Date Analyzed	Actual Holding Time (days)
012	Ground Water	10/29/86	10/30/86	nitrate nitrogen	10/30/86	1
				nitrite nitrogen	10/30/86	1
				bromide	11/03/86	5
				chloride	11/04/86	6
				fluoride	11/19/86	21
				phosphate	11/19/86	21
				sulfate	11/20/86	22
013	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/86	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21
014	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/86	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21

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(CL5141A/10)

TABLE F.2.19 (Continued)

SAMPLE CHRONOLOGIES FOR COMMON ANIONS ANALYSES
OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Anion Analyzed	Date Analyzed	Actual Holding Time (days)
015	Ground Water Equipment Blank	10/29/86	10/30/86	nitrate nitrogen	10/30/86	1
				nitrite nitrogen	10/30/86	1
				bromide	11/03/86	5
				chloride	11/04/86	6
				fluoride	11/19/86	21
				phosphate	11/19/86	21
				sulfate	11/20/86	22
017	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/86	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21
018	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/86	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21

Table continued on next page.

(CL5141A/10)

TABLE F.2.19 (Continued)

SAMPLE CHRONOLOGIES FOR COMMON ANIONS ANALYSES
OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Anion Analyzed	Date Analyzed	Actual Holding Time (days)
019	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/86	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21
020	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/86	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21
021	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/86	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21

Table continued on next page.

(CL5141A/10)

TABLE F.2.19 (Continued)

SAMPLE CHRONOLOGIES FOR COMMON ANIONS ANALYSES
OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Anion Analyzed	Date Analyzed	Actual Holding Time (days)
022	Ground Water	10/30/86	10/31/86	nitrate nitrogen	10/31/86	1
				nitrite nitrogen	10/31/86	1
				bromide	11/03/86	4
				chloride	11/04/86	5
				fluoride	11/19/86	20
				phosphate	11/19/86	20
				sulfate	11/20/86	21
023	Surface Water	11/02/86	11/03/86	nitrate nitrogen	11/03/86	1
				nitrite nitrogen	11/04/86	2
				bromide	11/21/86	19
				chloride	11/04/86	2
				fluoride	11/19/86	17
				phosphate	11/21/86	19
				sulfate	11/20/86	18
024	Surface Water	11/02/86	11/03/86	nitrate nitrogen	11/03/86	1
				nitrite nitrogen	11/04/86	2
				bromide	11/21/86	19
				chloride	11/04/86	2
				fluoride	11/19/86	17
				phosphate	11/21/86	19
				sulfate	11/20/86	18

Table continued on next page.

(CL5141A/10)

TABLE F.2.19 (Continued)

SAMPLE CHRONOLOGIES FOR COMMON ANIONS ANALYSES
OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received by Laboratory	Anion Analyzed	Date Analyzed	Actual Holding Time (days)
025	Surface Water	11/02/86	11/03/86	nitrate nitrogen	11/03/86	1
				nitrite nitrogen	11/04/86	2
				bromide	11/21/86	19
				chloride	11/04/86	2
				fluoride	11/19/86	17
				phosphate	11/21/86	19
				sulfate	11/20/86	18
026	Surface Water	11/02/86	11/03/86	nitrate nitrogen	11/03/86	1
				nitrite nitrogen	11/04/86	2
				bromide	11/21/86	19
				chloride	11/04/86	2
				fluoride	11/19/86	17
				phosphate	11/21/86	19
				sulfate	11/20/86	18
027	Surface Water	11/02/86	11/03/86	nitrate nitrogen	11/03/86	1
				nitrite nitrogen	11/04/86	2
				bromide	11/21/86	19
				chloride	11/04/86	2
				fluoride	11/19/86	17
				phosphate	11/21/86	19
				sulfate	11/20/86	18

(CL5141A/10)

TABLE F.2.20

SAMPLE CHRONOLOGIES FOR TOTAL DISSOLVED SOLIDS
ANALYSIS OF WATER SAMPLES

HART Sample Number	Type of Sample	Date Collected	Date Received By Laboratory	Date Analyzed	Actual Holding Time (days)
001	Ground Water	10/30/86	10/31/86	10/31/86	1
003	Ground Water	10/30/86	10/31/86	10/31/86	1
004	Ground Water	10/29/86	10/30/86	10/31/86	2
005	Ground Water	10/29/86	10/30/86	10/31/86	2
006	Ground Water	10/29/86	10/30/86	10/31/86	2
007	Ground Water	10/30/86	10/31/86	10/31/86	1
012	Ground Water	10/29/86	10/30/86	10/31/86	2
013	Ground Water	10/30/86	10/31/86	10/31/86	1
014	Ground Water	10/30/86	10/31/86	10/31/86	1
015	Ground Water	10/29/86	10/30/86	10/31/86	2
	Equipment Blank				
017	Ground Water	10/30/86	10/31/86	10/31/86	1
018	Ground Water	10/30/86	10/31/86	10/31/86	1
019	Ground Water	10/30/86	10/31/86	10/31/86	1
020	Ground Water	10/30/86	10/31/86	10/31/86	1
021	Ground Water	10/30/86	10/31/86	10/31/86	1
022	Ground Water	10/30/86	10/31/86	10/31/86	1
023	Surface Water	11/02/86	11/03/86	11/05/86	3
024	Surface Water	11/02/86	11/03/86	11/05/86	3
025	Surface Water	11/02/86	11/03/86	11/05/86	3
026	Surface Water	11/02/86	11/03/86	11/05/86	3
027	Surface Water	11/02/86	11/03/86	11/05/86	3

(CL5140A/11)

TABLE IV-F.2.21

COMPARISON OF WATER QUALITY CRITERIA TO PTL DETECTION LIMITS FOR EPA METHOD 601/602: AROMATIC AND HALOGENATED VOLATILE ORGANIC ANALYSES

Parameter	Detection Limits Water ug/l	Detection Limits Soil ug/kg	Available Water Quality Criteria ug/l
Halogenated Volatile Organics			
Chloromethane	20	800	0.19(e)
Bromomethane	10	400	0.19(e)
Dichlorodifluoromethane	5	200	0.19(e)
Vinyl Chloride	2	80	2.0(a);0(k);1(l)
Chloroethane	2	80	No established level
Methylene Chloride	5	200	150(h)
Trichlorofluoromethane	5	200	0.19(e)
1,1-Dichloroethene	1	40	0.03(a);7.0(k);7.0(l)
1,1-Dichloroethane	1	40	No established level
Trans-1,2-Dichloroethene	1	40	270(g);70(c)
Chloroform	2	40	0.19(a);100(f)
1,2-Dichloroethane	1	40	0.94(a);0(k);5.0(l)
1,1,1-Trichloroethane	2	80	18,400(d);1,000(i);200(k);200(l)
Carbon Tetrachloride	2	80	0.4(a);20(g);0(k);5.0(l)
Bromodichloromethane	2	80	0.19(e); 100(f)
1,2-Dichloropropane	1	40	6(c)
Trans-1,3-Dichloropropene	5	200	87(d)
Trichloroethene	2	80	2.7(a);0(k);5.0(l);2,000(j)
Dibromochloromethane	2	80	100(f)
1,1,2-Trichloroethane	5	200	0.6(a)
Cis-1,3-Dichloropropene	5	200	87(d)
2-Chloroethylvinylether	5	200	No established level
Bromoform	10	400	0.19(e);100(f)
1,1,2,2-Tetrachloroethane	10	400	1.7(a)
Tetrachloroethene	2	80	0.8(a);20,000(k)
Aromatic Volatile Organics			
Benzene	1	40	0.66(a);0(k);5.0(l)
Toluene	1	40	14,300(d);2,000(c)
Chlorobenzene	1	40	No established level
Ethylbenzene	1	40	1,400(d);680(c)
1,3-Dichlorobenzene	1	40	400(d)
1,2-Dichlorobenzene	1	40	400(d);620(c)
1,4-Dichlorobenzene	1	40	400(d);750(k);750(l)

Legend appears on next page.

TABLE F.2.21 (Continued)

COMPARISON OF WATER QUALITY CRITERIA TO
PTL DETECTION LIMITS FOR EPA METHOD 601/602: AROMATIC AND
HALOGENATED VOLATILE ORGANIC ANALYSES

Legend:

(a) EPA Ambient Water Quality Criteria corresponding to an incremental increase in lifetime cancer risk of 10^{-6}; Federal Register, Vol. 45, No. 231, 11/28/80.

(b) National Interim Primary Drinking Water Standards: Maximum Contaminant Level; USEPA 40 CFR 141.

(c) Proposed Recommended Maximum Contaminant Level: NIPDWS, Federal Register, Vol. 50, No. 219, 11/13/85.

(d) EPA Ambient Water Quality Criteria based upon human health effects; Federal Register, Vol. 45, No. 231, 11/28/80.

(e) EPA Ambient Water Quality Criteria for total Halomethanes corresponding to an incremental increase in lifetime cancer risk of 10^{-6}; Federal Register, Vol. 45, No. 231, 11/28/80.

(f) National Interim Primary Drinking Water Standard for total Trihalomethanes; USEPA 40CFR141.

(g) Suggested No Adverse Response Level for ten day drinking water exposure; EPA, Vol. 3, No. 17, 4/30/82.

(h) Suggested No adverse Response Level for long-term drinking water exposure; EPA, Vol. 3, No. 17, 4/30/82.

(i) Suggested No Adverse Response Level for chronic drinking water exposure; EPA, Vol. 3, No. 17, 4/30/82.

(j) Suggested No Adverse Response Level for one day (child) drinking water exposure; EPA Vol. 3, No. 17, 4/30/82.

(k) National Interim Primary Drinking Water Standards; Recommended Maximum Contaminant Level; USEPA 40 CFR 141.

(l) Proposed Maximum Contaminant Level; NIPDWS, Federal Register, Vol. 50, No. 219, 11/13/85.

ug/l - micrograms per liter
ug/kg - micrograms per kilogram

(CL5141A/5)

TABLE F.2.22

COMPARISON OF WATER QUALITY CRITERIA TO PTL DETECTION LIMITS FOR EPA METHOD 625: ACID AND BASE/ NEUTRAL EXTRACTABLE PRIORITY POLLUTANT ORGANIC ANALYSES

Parameter	Detection Limit (Water) ug/l	Available Water Quality Criteria ug/l
Acenaphthene	10	20(a);0.0028(b)
Acenaphthylene	10	0.0028(b)
Anthracene	10	0.0028(b)
Benzidine	100	0.00012(c)
Benzo(a)Anthracene	10	0.0028(b)
Benzo(a)Pyrene	10	0.0028(b)
Benzo(b)Fluoranthene	10	0.0028(b)
Benzo(ghi)Perylene	10	0.0028(b)
Benzo(k)Fluoranthene	10	0.0028(b)
Bis(2-Chloroethoxy)Methane	10	No established level
Bis(2-Chloroethyl)Ether	10	0.03(c)
Bis(2-Chloroisopropyl)Ether	10	34.7(d)
Bis(2-Ethylhexyl)Phthalate	10	No established level
4-Bromophenyl Phenyl Ether	10	No established level
Butyl Benzyl Phthalate	10	No established level
2-Chloronaphthalene	10	0.0028(b)
4-Chlorophenyl Phenyl Ether	10	No established level
Chrysene	10	0.0028(b)
Dibenzo(a,h)Anthracene	10	0.0028(b)
1,2-Dichlorobenzene	10	40(c);620(e)
1,3-Dichlorobenzene	10	40(c)
1,4-Dichlorobenzene	10	40(c);750(f);750(g)
3,3'-Dichlorobenzidine	20	0.0103(c)
Diethyl Phthalate	10	350,000(d)
Dimethyl Phthalate	10	313,000(d)
Di-n-Butyl Phthalate	10	34,000(d)
2,4-Dinitrotoluene	10	0.11(c)
2,6-Dinitrotoluene	10	No established level
Di-n-Octylphthalate	10	No established level
1,2-Diphenylhydrazine	10	0.0422(c)
Fluoranthene	10	42(d)
Fluorene	10	0.0028(b)
Hexachlorobenzene	10	0.00072(c)
Hexachlorobutadiene	10	0.447(c)
Hexachlorocyclopentadiene	10	206(d);1.0(a)
Hexachloroethane	10	1.9(c)
Indeno(1,2,3-cd)Pyrene	10	0.0028(b)
Isophorone	10	5,200(d)
Naphthalene	10	No established level
Nitrobenzene	10	19,800(d);30,000(a)
N-Nitrosodimethylamine	10	0.0014(c)
N-Nitrosodi-n-Propylamine	10	No established level

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(CL5141A/5)

TABLE F.2.22 (Continued)

COMPARISON OF WATER QUALITY CRITERIA TO PTL DETECTION LIMITS FOR EPA METHOD 625: ACID AND BASE/ NEUTRAL EXTRACTABLE PRIORITY POLLUTANT ORGANIC ANALYSES

Parameter	Detection Limit (Water) ug/l	Available Water Quality Criteria ug/l
N-Nitrosodiphenylamine	10	4.9(c)
Phenanthrene	10	0.0028(b)
Pyrene	10	0.0028(b)
1,2,4-Trichlorobenzene	10	No established level
2-Chlorophenol	10	0.1(a)
2,4-Dichlorophenol	10	3,090(d);0.3(a)
2,4-Dimethylphenol	10	400(a)
4,6-Dinitro-2-Cresol	50	No established level
2,4-Dinitrophenol	50	70(d)
2-Nitrophenol	10	No established level
4-Nitrophenol	50	No established level
4-Chloro-3-Cresol	10	No established level
Pentachlorophenol	50	1,010(d);30(a);220(e)
Phenol	10	3,500(d);300(a)
2,4,6-Trichlorophenol	10	1.2(c)

Legend

(a) EPA Ambient Water Quality Criteria based upon organoleptic data; Federal; Register, Vol. 45, No. 231, 11/28/80.

(b) EPA Ambient Water Quality Criteria for Polynuclear Aromatic Hydrocarbons corresponding to an incremental increase in lifetime cancer risk of 10^{-6}; Federal Register, Vol. 45, No. 231, 11/28/80.

(c) EPA Ambient Water Quality Criteria corresponding to an incremental increase in lifetime cancer risk of 10^{-6}, Federal Register, Vol. 45, No. 231, 11/28/80.

(d) EPA Ambient Water Quality Criteria based upon human health effects; Federal Register, Vol. 45, No. 231, 11/28/80.

(e) Proposed Recommended Maximum Contaminant Level; NIPDWS, Federal Register, Vol. 50, No. 219, 11/13/85.

(f) National Interim Primary Drinking Water Standards; Recommended Maximum Contaminant Level; USEPA 40 CFR 141.

(g) Proposed Maximum Contaminant Level; NIPDWS, Federal Register, Vol. 50, No. 219, 11/13/85.

ug/l - micrograms per liter

(CL5141A/5)

TABLE F.2.23

COMPARISON OF WATER QUALITY CRITERIA TO
PTL ANALYTICAL PROCEDURES AND DETECTION LIMITS FOR PRIORITY POLLUTANT METALS, COMMON ANIONS, TOTAL DISSOLVED SOLIDS AND TOTAL PETROLEUM HYDROCARBON ANALYSES

Parameter	Analytical Procedures		PTL Detection Limits		Available Water Quality Criteria
	Water	Soil	Water mg/l	Soil mg/kg	mg/l
Priority Pollutant Metals					
Beryllium	EPA 210.1	SW 7090	0.05	2.5	$3.7X10^{-6}$(a)
Cadmium	EPA 213.1	SW 7130	0.005	0.5	0.01(b);0.01(f,i);0.005(h)
Chromium	EPA 218.1	SW 7190	0.02	1.0	170(c);0.05(d,f,i);0.12(h)
Copper	EPA 220.1	SW 7210	0.02	1.0	1.0(e);1.0(g);1.3(h);0.05((i)
Nickel	EPA 249.1	SW 7520	0.01	2.0	0.0134(b)
Lead	EPA 239.1	SW 7420	0.02	1.0	0.05(b,f,i);0.02(h)
Zinc	EPA 289.1	SW 7950	0.02	0.5	5.0(e,g);1.0(i)
Arsenic	EPA 206.2	SW 7060	0.01	0.5	$2.2X10^{-6}$(a);0.05(f,h,i)
Silver	EPA 272.1	SW 7760	0.01	0.5	0.05(b,f)
Antimony	EPA 204.1	SW 7040	0.10	10.0	0.146(b)
Selenium	EPA 270.2	SW 7740	0.01	0.5	0.01(b,f,i);0.045(h)
Thallium	EPA 279.1	SW 7840	0.01	5.0	0.013(b)
Mercury	EPA 245.1	SW 7470	0.001	0.10	$1.44X10^{-4}$(b);0.002(f);0.003(h)
Common Anions					
Chloride	SM 407A	NA	1.0	NA	250(g);100(i)
Flouride	EPA 340.1	NA	0.1	NA	2.0(f)
Bromide	SM Part406	NA	0.1	NA	None
Nitrate	EPA 352.1	NA	0.1	NA	10(f,h);1.0(i)
Nitrite	SM 419	NA	0.01	NA	1.0(h)
Phosphate	EPA 365.2	NA	0.1	NA	0.1(i)
Sulfate	EPA 375.4	NA	1.0	NA	250(g,i)
Total Dissolved Solids	EPA 160.1	NA	2.0	NA	500(g)
Total Petroleum Hydrocarbons	EPA 418.1	EPA 418.1	0.5	10.0	None

Legend

(a) EPA Ambient Water Quality Criteria corresponding to an incremental increase in lifetime cancer risk of 10^{-6}; Federal Register, Vol. 45, No. 231, 11/28/80.

(b) EPA Ambient Water Quality based upon human health effects; Federal Register, Vol. 45, No. 231, 11/28/80.

(c) Same as (b) for Chromium III.

(d) Same as (b) for Chromium IV.

(e) EPA Ambient Water Quality Criteria based upon organoleptic data; Federal register, Vol. 45, No. 231, 11/28/80.

(f) National Interim Primary Drinking Water Standards: Maximum Contaminant Level; USEPA 40 CFR 141.

Legend continued on next page.

(CL5141A/5)

TABLE F.2.23 (Continued)

COMPARISON OF WATER QUALITY CRITERIA TO
PTL ANALYTICAL PROCEDURES AND DETECTION LIMITS FOR PRIORITY POLLUTANT METALS,
COMMON ANIONS, TOTAL DISSOLVED SOLIDS AND TOTAL PETROLEUM HYDROCARBON ANALYSES

(g) National Secondary Drinking Water Standards; USEPA 40CFR143.

(h) Proposed Recommended Maximum Contaminant Level; Federal Register, Vol. 50, No. 219, 11/13/85.

(i) North Dakota Water Quality Standards; North Dakota Department of Health Rule 33-16-02, Section 06.

mg/l - milligrams per liter
mg/kg - milligrams per kilogram

TABLE F.2.24

BASE/NEUTRAL EXTRACTABLE ORGANIC ANALYSES

SURROGATE RECOVERY DATA FOR PTL JOB NO. 86GW3538 WATER SAMPLES

Suurogate Compounds	Percent Recovery Results For Surrogate Spike Compounds					
	Method Blank	023	024	025	026	026
2-Fluorophenol	132	111	109	91	117	95
D5-phenol	71	67	70	69	67	57
D5-Nitrobenzene	39	39	41	36	29	34
2-Fluorobiphenyl	50	47	52	41	36	41
2,4,6-Tribromophenol	219	230	171	310	164	151

(CL5056B/28)

TABLE F.2.25

BASE/NEUTRAL EXTRACTABLE ORGANIC ANALYSES

SURROGATE RECOVERY DATA FOR PTL JOB NO. 86GW3506 WATER SAMPLES

Surrogate Compounds	Percent Recovery Results For Surrogate Spike Compounds				
	004	005	006	012	015
2-Fluorophenol	70	99	86	76	78
D5-Phenol	69	71	61	49	49
D5-Nitrobenzene	53	42	35	35	26
2-Fluorobiphenyl	86	78	40	34	31
2,4,6-Tribromophenol	100	161	212	174	173

(CL5056B/30)

TABLE F.2.26

BASE/NEUTRAL EXTRACTABLE ORGANIC ANALYSES

SURROGATE RECOVERY DATA FOR PTL JOB NO. 86GW3523 WATER SAMPLES

Surrogate Compounds	Percent Recovery Results For Surrogate Spike Compounds										
	Method Blank	001	003	007	013	014	017	018	019	020	021
2-Fluorophenol	44	119	118	125	176	86	38	35	80	111	76
D5-Phenol	37	67	67	71	150	52	22	26	44	74	45
D5-Nitrobenzene	25	48	42	48	41	44	36	46	30	36	49
2-Fluorobiphenyl	45	55	53	59	55	51	43	56	38	45	60
2,4,6-Tribromophenol	161	213	192	190	177	230	198	144	218	158	217

(CL5056B/31)

TABLE F.2.27

DUPLICATE AND MATRIX SPIKE ANALYSES RESULTS FOR PRIORITY POLLUTANT METALS ANALYSES OF PTL JOB NO. 86GW3506 WATER SAMPLES

		Duplicate Analyses Results (mg/l)			Matrix Spike Analyses Results (mg/l)		
Metals	Samples	First Run	Second Run	RPD*	Spike Added	Total Recovery	Percent Recovery**
Beryllium	006	ND	ND	NA	0.150	0.132	88
Cadmium	006	ND	ND	NA	0.150	0.159	106
Chromium	006	ND	ND	NA	0.150	0.153	102
Copper	006	0.03	0.03	0	0.150	0.179	99
Nickel	006	ND	ND	NA	0.150	0.149	99
Lead	006	0.025	0.026	4	0.150	0.152	84
Zinc	006	0.087	0.088	1	0.150	0.254	111
Arsenic	NP	NP	NP	NP	NP	NP	NP
Silver	006	0.02	0.02	0	0.150	0.153	89
Selenium	NP	NP	NP	NP	NP	NP	NP
Thallium	006	ND	ND	NA	0.150	0.139	93
Mercury	005	ND	ND	NA	0.005	0.0048	96

Legends appear on next page.

(CL5056B/32)

TABLE F.2.27 (Continued)

DUPLICATE AND MATRIX SPIKE ANALYSES RESULTS FOR PRIORITY POLLUTANT METALS ANALYSES OF PTL JOB NO. 86GW3506 WATER SAMPLES

Legend

mg/l - milligrams per liter
RPD - Relative Percent Difference
*Calculated by the following equation:

$$RPD = \frac{(Run\ 1 - Run\ 2)}{[(Run\ 1 + Run\ 2)/2]} \times 100$$

ND - Not Detected
NA - Not Applicable
NP - Not Performed

**Calculated by the following equation:

$$\%\ Recovery = \frac{(Spike\ Sample\ Result - Sample\ Result)}{Spike\ Added} \times 100$$

(CL5056B/32)

TABLE F.2.28

DUPLICATE AND MATRIX SPIKE ANALYSES RESULTS FOR PRIORITY POLLUTANT METALS ANALYSES OF PTL JOB NO. 86GW3523 WATER SAMPLES

		Duplicate Analyses Results (mg/l)			Matrix Spike Analyses Results (mg/l)		
Metals	Samples	First Rum	Second Run	RPD*	Spike Added	Total Recovery	Percent Recovery**
Beryllium	007	ND	ND	NA	0.150	0.129	86
Cadmium	007	ND	ND	NA	0.150	0.157	105
Chromium	007	ND	ND	NA	0.150	0.154	103
Copper	007	0.03	0.03	0	0.150	0.182	101
Nickel	007	ND	ND	NA	0.150	0.148	99
Lead	007	ND	ND	NA	0.150	0.152	101
Zinc	007	0.058	0.061	5	0.150	0.214	103
Arsenic	014	ND	ND	NA	0.20	0.172	86
Silver	007	ND	ND	NA	0.150	0.129	86
Selenium	014	ND	ND	NA	0.20	0.188	94
Thallium	007	ND	ND	NA	0.150	0.134	89
Mercury	014	ND	ND	NA	0.005	0.0046	92

Legends appear on next page.

(CL5056B/32)

TABLE F.2.28 (Continued)

DUPLICATE AND MATRIX SPIKE ANALYSES RESULTS FOR PRIORITY POLLUTANT METALS ANALYSES OF PTL JOB NO. 86GW3523 WATER SAMPLES

Legend

mg/l - milligrams per liter
RPD - Relative Percent Difference
*Calculated by the following equation:

$$RPD = \frac{(Run\ 1 - Run\ 2)}{[(Run\ 1 + Run\ 2)/2]} \times 100$$

ND - Not Detected
NA - Not Applicable

**Calculated by the following equation:

$$\%\ Recovery = \frac{(Spike\ Sample\ Result - Sample\ Result)}{Spike\ Added} \times 100$$

(CL5056B/32)

TABLE F.2.29

DUPLICATE AND MATRIX SPIKE ANALYSES RESULTS FOR PRIORITY POLLUTANT METALS ANALYSES OF PTL JOB NO. 86GW3538 WATER SAMPLES

		Duplicate Analyses Results (mg/l)			Matrix Spike Analyses Results (mg/l)		
Metals	Samples	First Run	Second Run	RPD*	Spike Added	Total Recovery	Percent Recovery**
Beryllium	NP	NP	NP	NP	NP	NP	NP
Cadmium	027	ND	ND	NA	0.150	0.153	102
Chromium	NP	NP	NP	NP	NP	NP	NP
Copper	027	0.04	0.04	0	0.150	0.204	109
Nickel	027	0.013	0.014	7	0.150	0.147	89
Lead	027	ND	ND	NA	0.150	0.148	99
Zinc	027	0.24	0.185	26	0.150	0.349	86
Arsenic	024	ND	ND	NA	0.2	0.186	93
Silver	027	ND	ND	NA	0.150	0.131	87
Selenium	024	ND	ND	NA	0.2	0.174	87
Thallium	NP	NP	NP	NP	NP	NP	NP
Mercury	026	ND	NA	NA	0.005	0.0052	104

Legends appear on next page.

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TABLE F.2.29 (Continued)

DUPLICATE AND MATRIX SPIKE ANALYSES RESULTS FOR PRIORITY POLLUTANT METALS ANALYSES OF PTL JOB NO. 86GW3538 WATER SAMPLES

Legend

mg/l - milligrams per liter
RPD - Relative Percent Difference
*Calculated by the following equation:

$$RPD = \frac{(Run\ 1 - Run\ 2)}{[(Run\ 1 + Run\ 2)/2]} \times 100$$

ND - Not Detected
NA - Not Applicable
NP - Not Performed

**Calculated by the following equation:

$$\%\ Recovery = \frac{(Spike\ Sample\ Result - Sample\ Result)}{Spike\ Added} \times 100$$

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TABLE F.2.30

DUPLICATE AND MATRIX SPIKE ANALYSES RESULTS FOR
COMMON ANIONS
ANALYSES OF PTL JOB NO. 86GW3506 WATER SAMPLES

		Duplicate Analyses Results (mg/l)			Matrix Spike Analyses Results (mg/l)		
Parameter	Samples	First Run	Second Run	RPD*	Spike Added	Total Recovery	Percent REcovery**
Chloride	005	58	62	6.67	NP	NP	NP
Nitrate Nitrogen	015	ND	ND	NA	0.20	0.225	112
Nitrite Nitrogen	015	ND	ND	NA	0.04	0.036	90

Legend:

mg/l - milligrams per liter
RPD - Relative Percent Difference
*Calculated by the following equation:

$$RPD = \frac{(Run\ 1 - Run\ 2)}{[(Run\ 1 + Run\ 2)/2]} \times 100$$

**Calculated by the following equation:

$$\%\ Recovery = \frac{(Spike\ Sample\ Result - Sample\ Result)}{Spike\ Added} \times 100$$

ND - Not Detected
NA - Not Applicable
NP - Not Performed

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TABLE F.2.31

DUPLICATE AND MATRIX SPIKE ANALYSES RESULTS FOR COMMON ANIONS AND TOTAL DISSOLVED SOLIDS ANALYSES OF PTL JOB NO. 86GW3523 WATER SAMPLES

		Duplicate Analyses Results (mg/l)			Matrix Spike Analyses Results (mg/l)		
Parameter	Samples	First Run	Second Run	RPD*	Spike Added	Total Recovery	Percent Recovery**
Chloride	021	35	35	0	NP	NP	NP
Fluoride	008	0.87	0.82	5.9	0.40	1.20	88
Bromide	001	ND	0.50	NA	2.0	2.1	93
Nitrate Nitrogen	020	ND	ND	NA	0.20	0.20	100
Nitrite Nitrogen	008	ND	ND	NA	0.04	0.038	95
Phosphate	018	0.14	0.15	6.9	0.50	0.63	96
Sulfate	008	1,650	1,700	3.0	1,000	2,850	117
TDS	017	1,896	1,918	1.15	NP	NP	NP

Legend:

mg/l - milligrams per liter
RPD - Relative Percent Difference
*Calculated by the following equation:

$$RPD = \frac{(Run\ 1 - Run\ 2)}{[(Run\ 1 + Run\ 2)/2]} \times 100$$

ND - Not Detected
NA - Not Applicable
NP - Not Performed
TDS - Total Dissolved Solids

**Calculated by the following equation:

$$\%\ Recovery = \frac{(Spike\ Sample\ Result - Sample\ Result)}{Spike\ Added} \times 100$$

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TABLE F.2.32

DUPLICATE AND MATRIX SPIKE ANALYSES RESULTS FOR
COMMON ANIONS AND TOTAL DISSOLVED SOLIDS
ANALYSES OF PTL JOB NO. 86GW3538 WATER SAMPLES

		Duplicate Analyses Results (mg/l)			Matrix Spike Analyses Results (mg/l)		
Parameter	Samples	First Run	Second Run	RPD*	Spike added	Total Recovery	Percent Recovery**
Fluoride	026	1.5	1.5	0	0.40	1.86	90
Bromide	025	2.4	3.0	22	2.0	4.3	80
Nitrate Nitrogen	027	1.27	0.83	42	0.20	1.2	90
Phosphate	026	ND	ND	NA	0.50	0.52	104
Sulfate	026	3,650	3,300	10.1	1,000	4,500	100
TDS	024	2,625	2,567	2.2	NP	NP	NP

Legend:

mg/l - milligrams per liter
RPD - Relative Percent Difference
*Calculated by the following equation:

$$RPD = \frac{(Run\ 1 - Run\ 2)}{[(Run\ 1 + Run\ 2)/2]} \times 100$$

ND - Not Detected
NA - Not Applicable
TDS - Total Disolved Solids
NP - Not Performed

**Calculated by the following equation:

$$\%\ Recovery = \frac{(Spike\ Sample\ Result - Sample\ Result)}{Spike\ Added} \times 100$$

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TABLE F.2.33

LABORATORY RESULTS FOR REPLICATE SAMPLES

	Sample Identifiers	
HART Identifier -	MAFB,DW-4,GW-1,HART014*	MAFB,DW-5,GW-1,HART021
PTL Identifier -	SN014	SN021
Parameter	mg/l	mg/l
Priority Pollutant Metals		
Beryllium	ND	ND
Cadmium	ND	ND
Chromium	ND	ND
Copper	ND	ND
Nickel	ND	ND
Lead	ND	ND
Zinc	0.07	0.03
Arsenic	ND	ND
Silver	ND	ND
Antimony	ND	ND
Selenium	ND	ND
Thallium	ND	ND
Mercury	ND	ND
Common Anions		
Chloride	30	35
Fluoride	0.99	0.87
Bromide	ND	0.90
Nitrate	ND	0.13
Nitrite	ND	ND
Phosphate	0.18	0.14
Sulfate	4500	4800
Total Dissolved Solids	5036	4848
Total Petroleum Hydrocarbons	ND	0.8
Aromatic Volatile Organics	ND[1]	ND[1]
Halogenatic Volatile Organics	ND[1]	ND[1]
Acid Extractable Priority Pollutant Organics	ND[1]	ND[1]
Base/Neutral Extractable Priority Pollutant Organics	ND[1]	ND[1]

LEGEND
- * Indicates actual Sample Identifier
- ND Not Detected
- 1 Analysis in ug/l

Table continued on next page.

TABLE F.2.33 (CONTINUED)

LABORATORY RESULTS FOR REPLICATE SAMPLES

	Sample Identifiers	
HART Identifier -	MAFB,SWA,S1,HART023*	MAFB,SWE,S1,HART027
PTL Identifier -	SN023	SN027
Parameter	mg/l	mg/l
Priority Pollutant Metals		
Beryllium	ND	ND
Cadmium	ND	ND
Chromium	ND	ND
Copper	0.03	0.04
Nickel	0.016	0.014
Lead	ND	ND
Zinc	0.03	0.22
Arsenic	ND	ND
Silver	ND	ND
Antimony	ND	ND
Selenium	ND	ND
Thallium	ND	ND
Mercury	ND	ND
Common Anions		
Chloride	400	380
Fluoride	1.5	1.5
Bromide	2.8	6.8
Nitrate	0.25	1.05
Nitrite	0.08	0.10
Phosphate	0.10	0.20
Sulfate	2400	2400
Total Dissolved Solids	4460	4761
Total Petroleum Hydrocarbons	ND	ND
Aromatic Volatile Organics	ND[1]	ND[1]
Halogenated Volatile Organics	ND[1]	ND[1]
Acid Extractable Priority Pollutant Organics	ND[1]	ND[1]
Base/Neutral Extractable Priority Pollutant Organics	ND[1]	ND[1]

LEGEND:
* Indicates actual sample identification
ND Not Detected
1 Analysis in ug/l

Table continued on next page.

TABLE F.2.33 (CONTINUED)

LABORATORY RESULTS FOR REPLICATE SAMPLES

	Sample Identifiers	
HART Identifier -	MAFB,SW-9,GW-1,HART009*	MAFB,SW-9,GW-2,HART010
PTL Identifier -	SN009	SN010
Parameter	ug/l	ug/l
Aromatic Volatile Organics	ND	ND
Halogenated Volatile Organics		
1,2 dichloroethane	ND	11 ug/l
1,1,1-trichloroethane	ND	11 ug/l
bromodichloromethane	ND	3 ug/l
trichloroethane	ND	4 ug/l
tetrachloroethane	ND	2 ug/l
All Others	ND	ND
Total Petroleum Hydrocarbons	0.5[1]	ND[1]
Lead	ND[1]	ND[1]

	Sample Identifiers	
HART Identifier -	MAFB,Tb-2,SS-5,HART010*	MAFB,Tb-2,SS-5,HART011
PTL Identifier -	HART010	HART011
Parameter	mg/l	mg/l
Priority Pollutant Metals		
Beryllium	ND	ND
Cadmium	ND	1.73
Chromium	1.39	1.46
Copper	12.8	12.70
Nickel	10.3	11.50
Lead	5.03	3.93
Zinc	60.01	59.10
Arsenic	ND	ND
Silver	1.43	0.58
Antimony	ND	ND
Selenium	ND	ND
Thallium	ND	ND
Mercury	0.10	0.16
Total Petroleum Hydrocarbons	ND	ND

LEGEND:
* Indicates actual sample identifier.
ND Not detected
1 Analysis in mg/l

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